



UNIVERSITY OF BAYREUTH

Department of Micrometeorology

Footprint synthesis
for the FLUXNET site
Waldstein/Weidenbrunnen (DE-Bay)
during the EGER experiment

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1 Introduction

This study presents the footprint analysis for the FLUXNET site Waldstein/Weidenbrunnen (DE-Bay). Two situations need to be distinguished: footprints calculated from measurements above a relatively undisturbed forest canopy, which was the typical situation prior to the year 2007. Secondly, footprints calculated from measurements above a disturbed forest canopy with large clearings due to the storm “Kyrill” on January, 18th 2008. Footprints from the undisturbed situation have previously been published (Göckede et al., 2005) in the context of CarboEurope related work. They are included for comparison purposes only. The main focus is on the footprint analysis after the storm during the EGER experiment in 2007 and 2008.

It should be noted that the aim of this study is the presentation of the footprint results for subsequent use and interpretation, not the interpretation itself.

2 Materials and Methods

2.1 Site

The FLUXNET site Waldstein/Weidenbrunnen (DE-Bay), 50° 08' 31" N, 11° 52' 01" E, is a hill site in the Fichtelgebirge Mountains in Southern Germany. The 23 m high Norway spruce stand is in the upper section of a hill, 775 m ASL, with a 2° slope facing SW (Figure 1). The site is described in detail in Gerstberger et al. (2004) and a summary of background data can be found in Staudt and Foken (2007). There are two tall towers at the site, one that has been used for FLUXNET measurements for several years, hereafter referred to as “main tower” or “MT”, and a second one, 50 m south-east of the first, which was set up in 2007, hereafter referred to as “turbulence tower” or “TT”.

2.2 Data sets

Data sets from three experiments were used. Firstly from the experiment “WaveLet Detection and Atmospheric Turbulence Exchange Measurement” (WALDATEM-2003), 28th of April to 03rd of August 2003 (Thomas et al., 2004), which corresponds to the situation prior to the storm (Göckede et al., 2005). Secondly from the experiment “ExchanGE processes in mountainous Regions” (EGER) Intensive Observation Period IOP1, 06th of September to 7rd of October 2007 (Serafimovich et al., 2008a). Thirdly from EGER

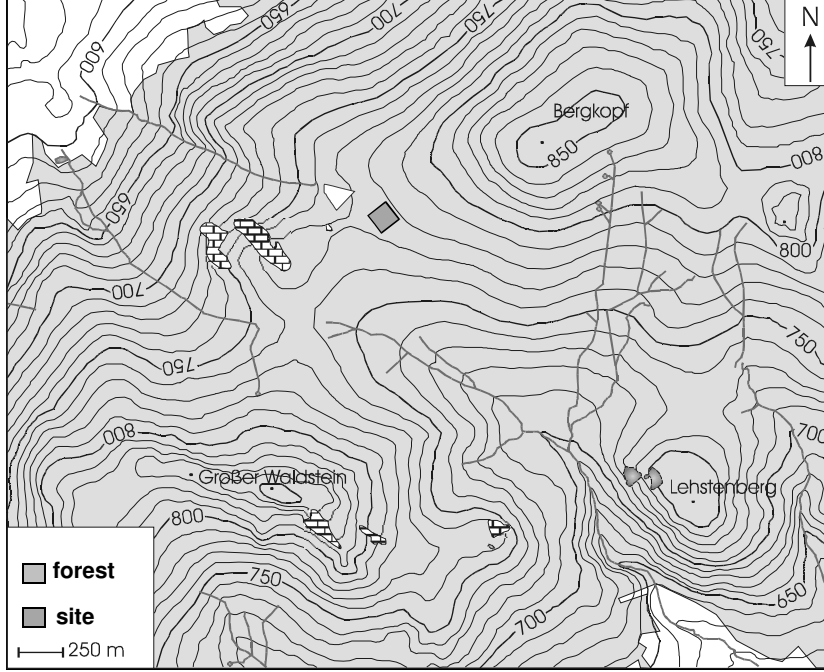


Figure 1: Map showing the terrain surrounding the measurement site.

Intensive Observation Period IOP2, 01st of June to 15th of July 2008. The latter two correspond to the situation after the storm (Serafimovich et al., 2008b).

The WALDATEM 2003 data set was collected at the main tower, for EGER IOP1 in 2007 and IOP2 in 2008 there are separate data sets from the main tower and the turbulence tower. For EGER IOP1 and IOP2, there is a separate analysis for the main tower and for the turbulence tower respectively. According to the recommendation of Göckede et al. (2004b) to use a minimum data set length of three months for the footprint synthesis, an extended analysis is presented for EGER IOP2 at the turbulence tower in addition to the period covering the Intensive Observation Period IOP2 itself. Information about the length and time of each data set can be found in Table 1.

2.3 Footprint model and footprint synthesis

The footprint synthesis presented in this study follows a site evaluation methodology using a combination of quality criteria of flux data and footprint analysis presented in Göckede et al. (2004a,b, 2006) and used in the context of the quality assessment of FLUXNET sites within the framework of CarboEurope, as described in Göckede et al. (2005).

Table 1: Date, length and number of 30-minute values n of meteorological data sets used for the footprint synthesis. “MT” refers to the main tower and “TT” refers to the turbulence tower.

Data set	start date	end date	n
EGER IOP1 MT	14 th of Sept. 2007, 17:00	13 th of Oct. 2007, 18:30	1302
EGER IOP1 TT	19 th of Sept. 2007, 20:00	08 th of Oct. 2007, 06:30	873
EGER IOP2 MT	30 th of May 2008, 00:00	14 th of July 2008, 09:30	2103
EGER IOP2 TT	03 rd of June 2008, 11:00	15 th of July 2008, 23:30	1886
EGER IOP2 TT (extended period)	09 th of May 2008, 21:30	20 th of Oct. 2008, 09:30	4265
WALDATEM MT	21 st of May 2003, 00:00	31 st of July 2003, 24:00	3380

The footprint model itself uses a stochastic forward Lagrangian algorithm (Thomson, 1987) of Langevin type (Wilson and Sawford, 1996) in the implementation by Rannik et al. (2003). The model accounts for fluxes within the canopy and three-dimensional turbulent diffusion. However, it is subject to the limitations of the “inverted plume assumption” (Schmid, 2002), i.e. it is limited to horizontally homogeneous conditions.

Meteorological input data for the footprint calculation were prepared using the TK2 software (Mauder and Foken, 2004), which also delivers the quality flags presented in this study. Quality flags are calculated according to Foken and Wichura (1996) in a revised version (Foken et al., 2004). Quality flag 1 is best, 9 is worst.

Roughness length z_0 information as input for the footprint model was prepared using the “microscale aggregation model” from Hasager and Jensen (1999). Refer to Table 2 for actual z_0 values.

The synthesis of footprint and quality flags was done using the program “TERRAFEX” (Göckede et al., 2004b). The calculation of relative flux contribution from specific land use classes was done using the program “EXAS-ITE” (Göckede et al., 2004b).

2.4 Model settings

Measurement height was 33 m at the main tower and 36 m at the turbulence tower. Data with quality flags from 1 to 9 were used, i.e. no filtering was applied. Roughness length z_0 values used for coniferous forest and clearings are given in Table 2.

The model was set up to distinguish three classes of atmospheric stratifi-

Table 2: Roughness length of land use classes according to Hasager et al. (2002) used as input for the ”microscale aggregation model” (Hasager and Jensen, 1999). The value of the class ”Clearing, 2003” was increased relative to the recommended value for clearings of 0.3 to account for additional roughness due to bushes and small trees on the older clearings.

Land use class	z_0 -value [m]
Coniferous forest	1.8
Clearing, 2003	0.6
Clearing, 2007	0.3

cation according to the stability parameter ζ , measured above the canopy at 33 m (main tower) and 36 m (turbulence tower). ζ is defined as $\zeta = (z-d)L^{-1}$ with measurement height z , displacement height d and Obukhov-length L . The four classes used are

$$\zeta = \begin{cases} \textit{unstable} & \text{for } \zeta < -0,0625 \\ \textit{neutral} & \text{for } -0,0625 < \zeta < +0,0625 \\ \textit{stable} & \text{for } +0,0625 < \zeta \\ \textit{all} & \text{for } -\infty < \zeta < +\infty \end{cases}$$

2.5 Land use map

The land use map used for EGER IOP1 and IOP2 (see Figure 2) differentiates clearings present before and after the storm, respectively. It is based on image material from a flight on the 16th of March 2007. There are certain restrictions regarding the accuracy of shape and position of the clearings due to the tilted view of the image material. The spatial resolution of the derived land use map is 10 m. The land use map from Göckede et al. (2005) used for the WALDATEM experiment results shown in Section 6 is based on a satellite image classification with a spatial resolution of 30 m.

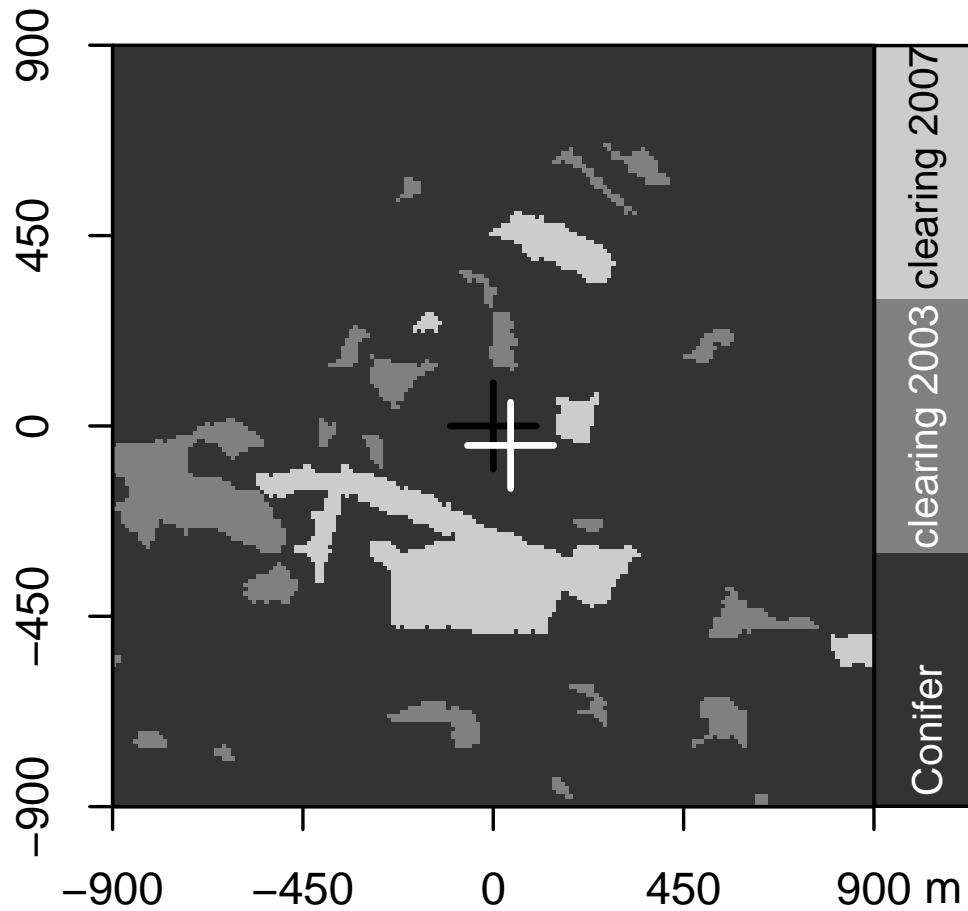


Figure 2: Land use map showing coniferous forest and clearings. “clearing 2003” refers to all clearings present in the year 2003, even if they are older. “clearing 2007” refers to clearings from wind throw and logging associated with the storm Kyrill on 18th of January 2007. Please refer to Appendix A for further information about logging activities related to the storm. X- and y-axis are distances in meters.

3 Results for EGER IOP1 2007

3.1 Footprint synthesis - main tower

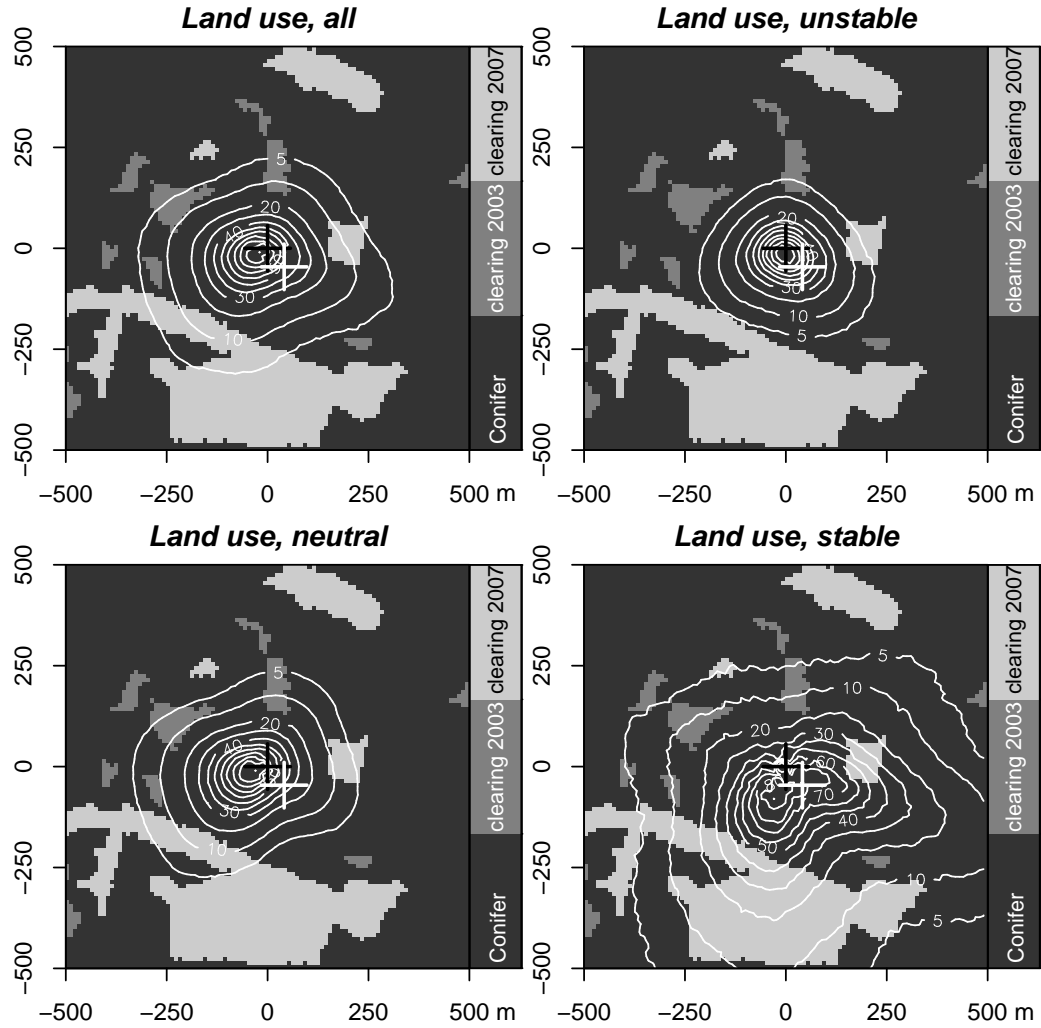


Figure 3: Footprint climatology over land use map, EGER IOP1, main tower, for four classes of atmospheric stratification. White isolines show the relative flux contribution of the corresponding footprint area in 10 % intervals. The outermost isoline indicates the area where 95 % of the flux is coming from. The black cross indicates the position of the main tower, the white cross the position of the turbulence tower. The plot is a map projection. X- and y-axis are distances in meters.

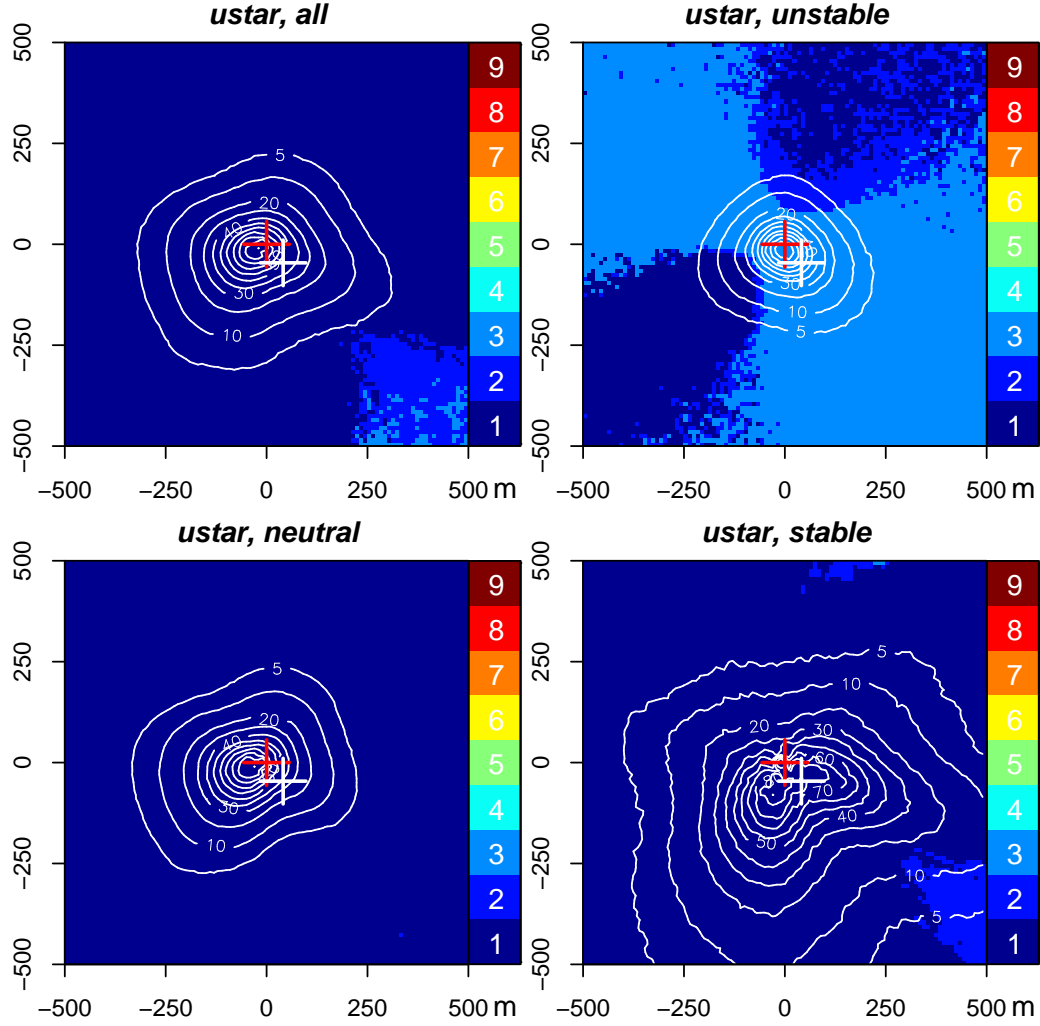


Figure 4: Footprint climatology and spatial quality flag features for **friction velocity, EGER IOP1, main tower**, for four classes of atmospheric stratification. White isolines show the relative flux contribution of the corresponding footprint area in 10 % intervals. The outermost isoline indicates the area where 95 % of the flux is coming from. Quality flags of the flux from 1 to 9 are color coded. The red cross indicates the position of the main tower, the white cross the position of the turbulence tower. The plot is a map projection. X- and y-axis are distances in meters.

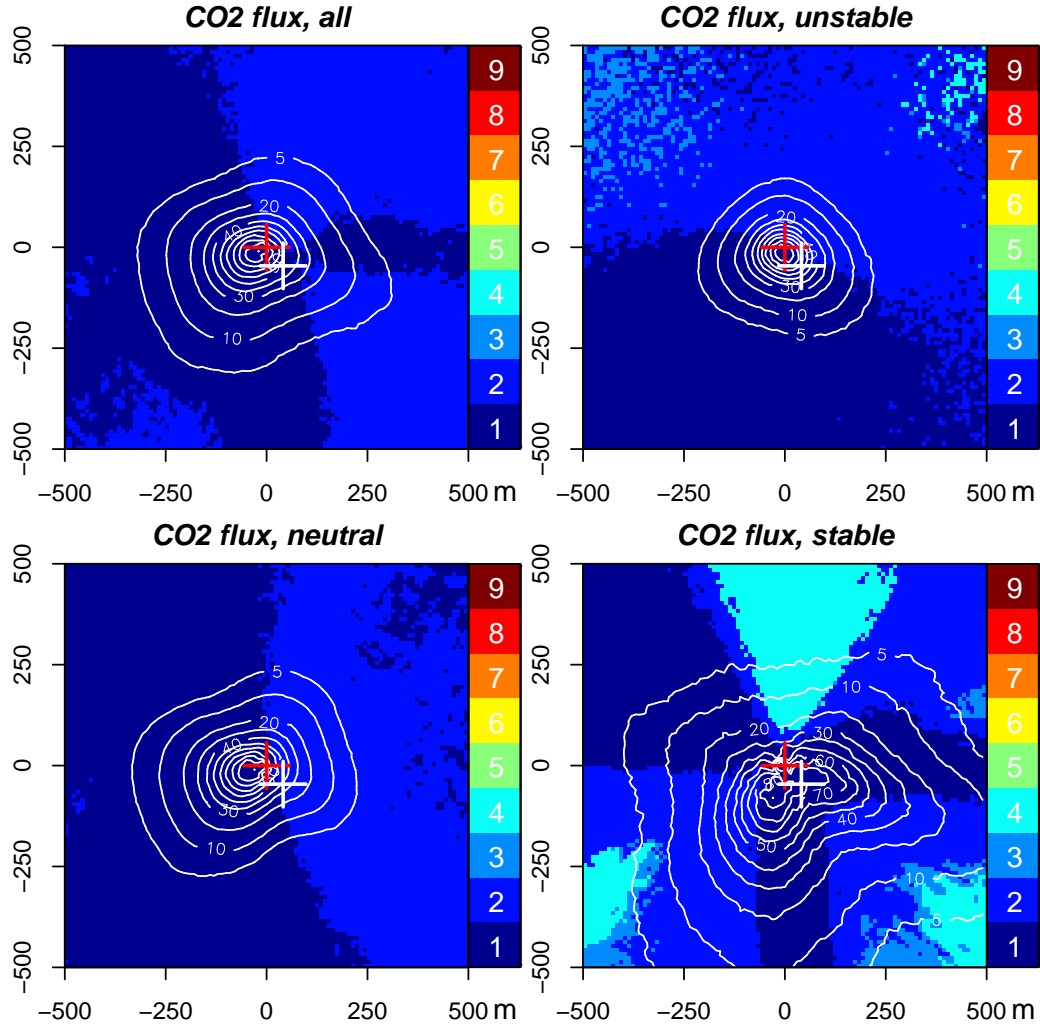


Figure 5: Footprint climatology and spatial quality flag features for the **CO₂ flux, EGER IOP1, main tower**, for four classes of atmospheric stratification. White isolines show the relative flux contribution of the corresponding footprint area in 10 % intervals. The outermost isoline indicates the area where 95 % of the flux is coming from. Quality flags of the flux from 1 to 9 are color coded. The red cross indicates the position of the main tower, the white cross the position of the turbulence tower. The plot is a map projection. X- and y-axis are distances in meters.

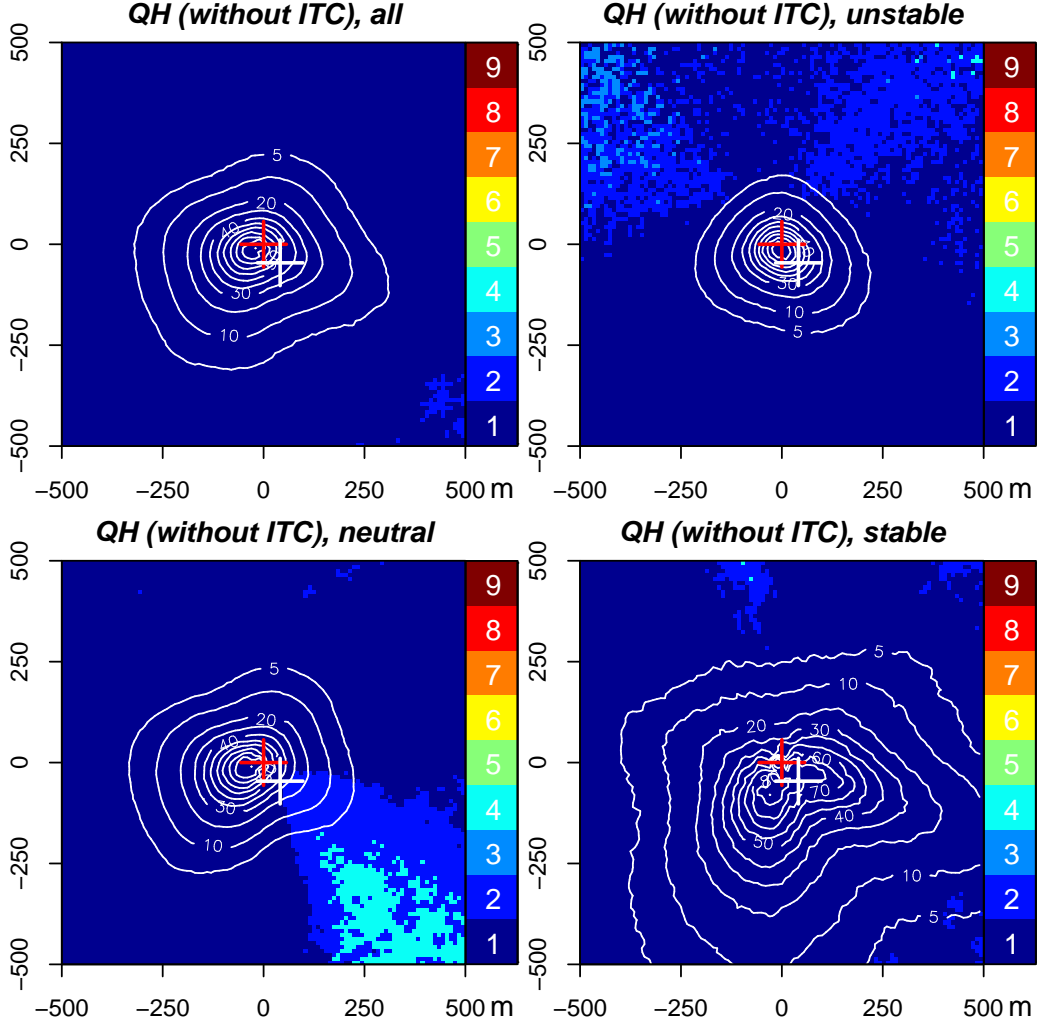


Figure 6: Footprint climatology and spatial quality flag features for the **sensible heat flux, EGER IOP1, main tower**, for four classes of atmospheric stratification. White isolines show the relative flux contribution of the corresponding footprint area in 10 % intervals. The outermost isoline indicates the area where 95 % of the flux is coming from. Quality flags of the flux from 1 to 9 are color coded. The red cross indicates the position of the main tower, the white cross the position of the turbulence tower. The plot is a map projection. X- and y-axis are distances in meters.

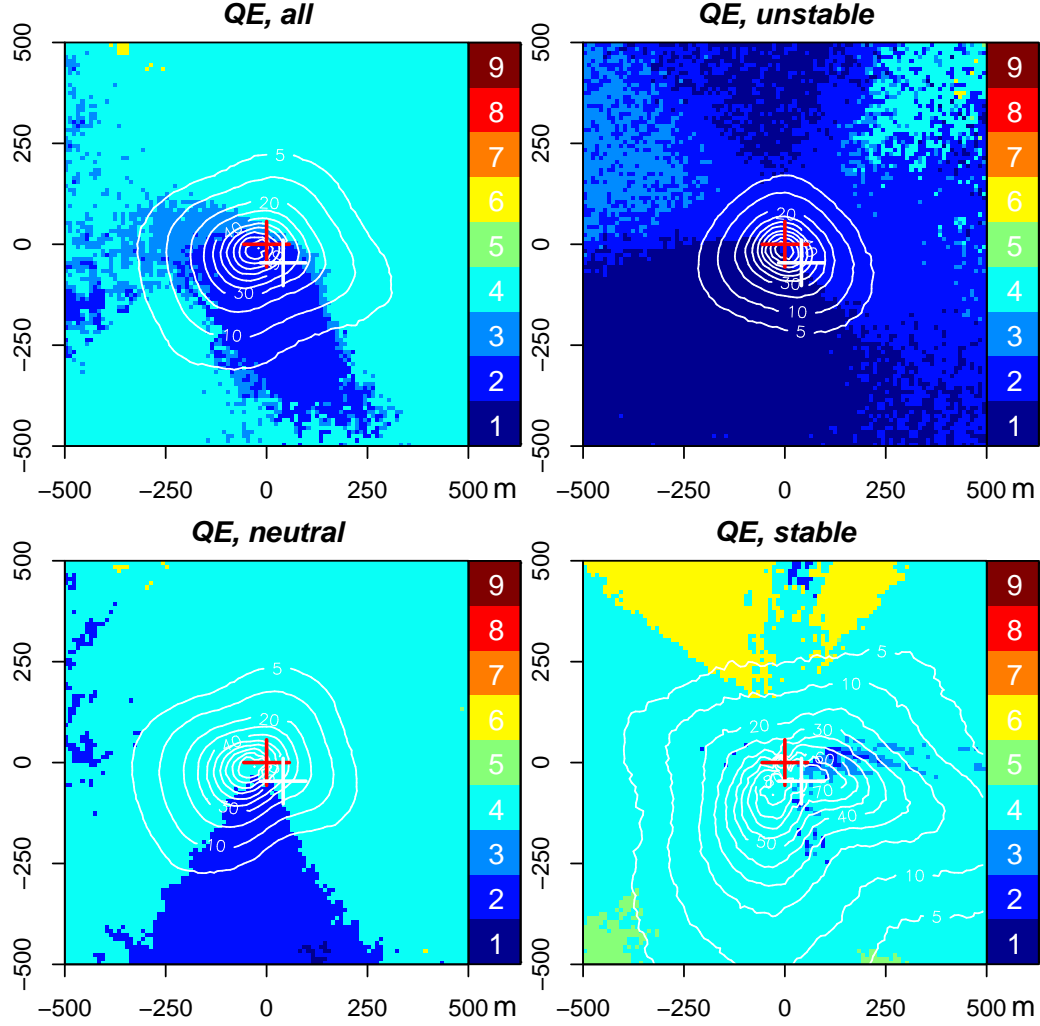


Figure 7: Footprint climatology and spatial quality flag features for the **latent heat flux, EGER IOP1, main tower**, for four classes of atmospheric stratification. White isolines show the relative flux contribution of the corresponding footprint area in 10 % intervals. The outermost isoline indicates the area where 95 % of the flux is coming from. Quality flags of the flux from 1 to 9 are color coded. The red cross indicates the position of the main tower, the white cross the position of the turbulence tower. The plot is a map projection. X- and y-axis are distances in meters.

3.2 Land use fractions - main tower

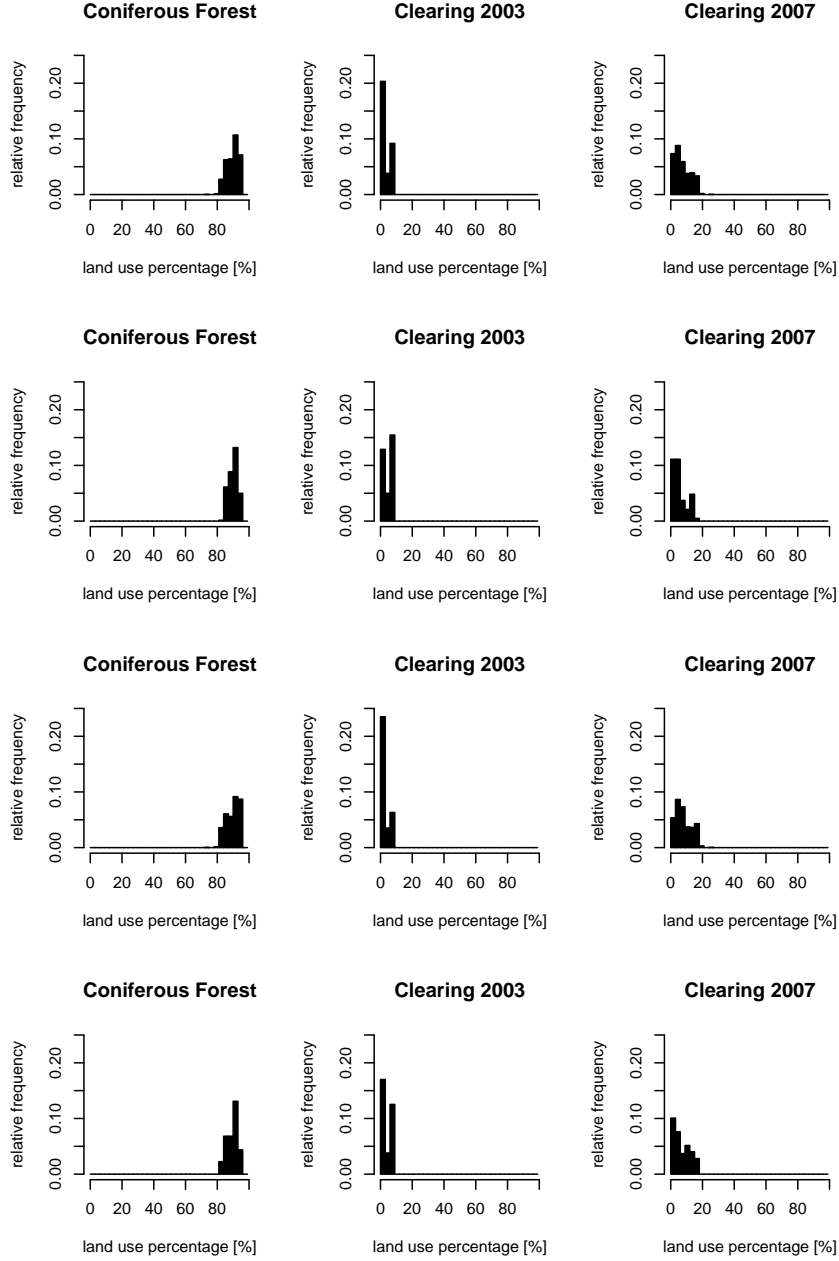


Figure 8: Relative contribution of different land use classes to the flux, **EGER IOP1, main tower**, for four classes of atmospheric stratification: all stratifications (top panel), unstable (second panel from top), neutral (third panel from top) and stable (bottom panel).

3.3 Footprint synthesis - turbulence tower

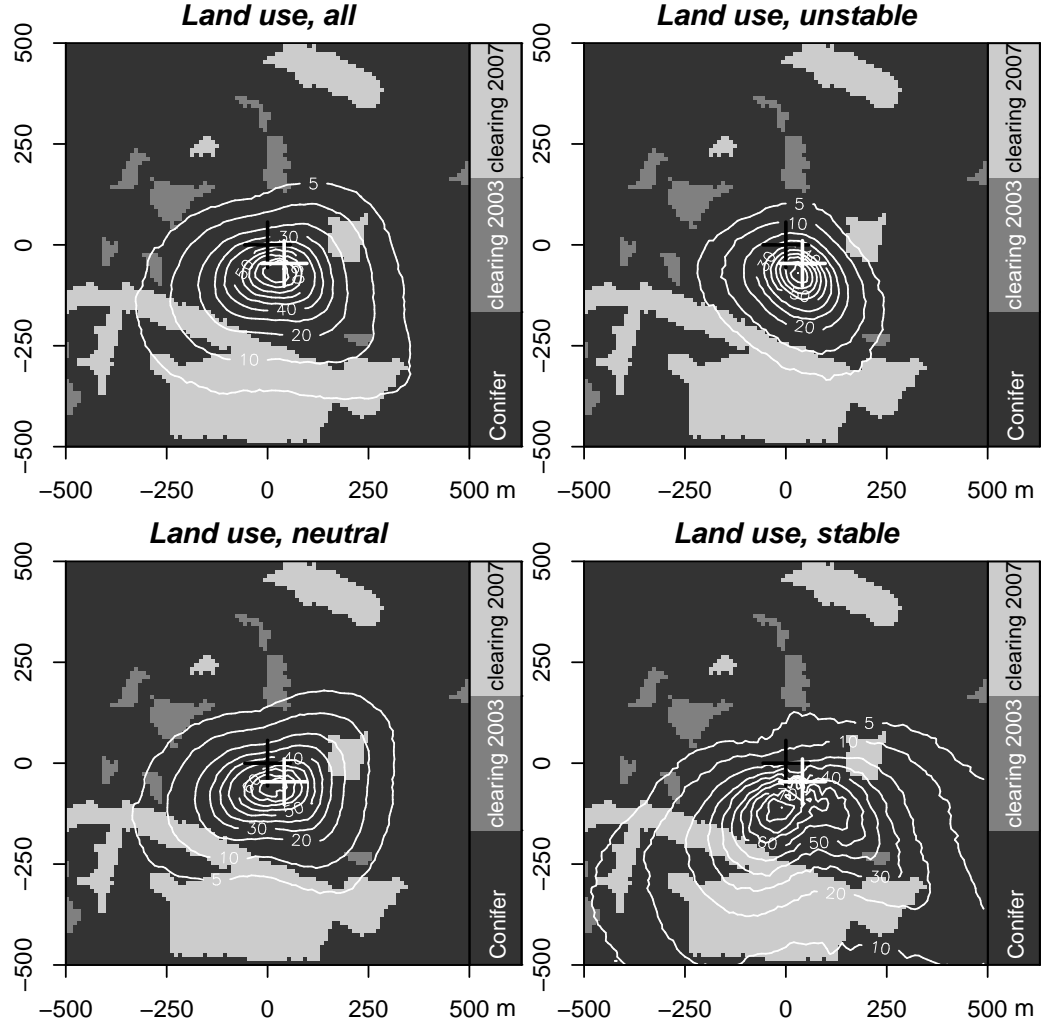


Figure 9: Footprint climatology over land use map, EGER IOP1, turbulence tower, for four classes of atmospheric stratification. White isolines show the relative flux contribution of the corresponding footprint area in 10 % intervals. The outermost isoline indicates the area where 95 % of the flux is coming from. The black cross indicates the position of the main tower, the white cross the position of the turbulence tower. The plot is a map projection. X- and y-axis are distances in meters.

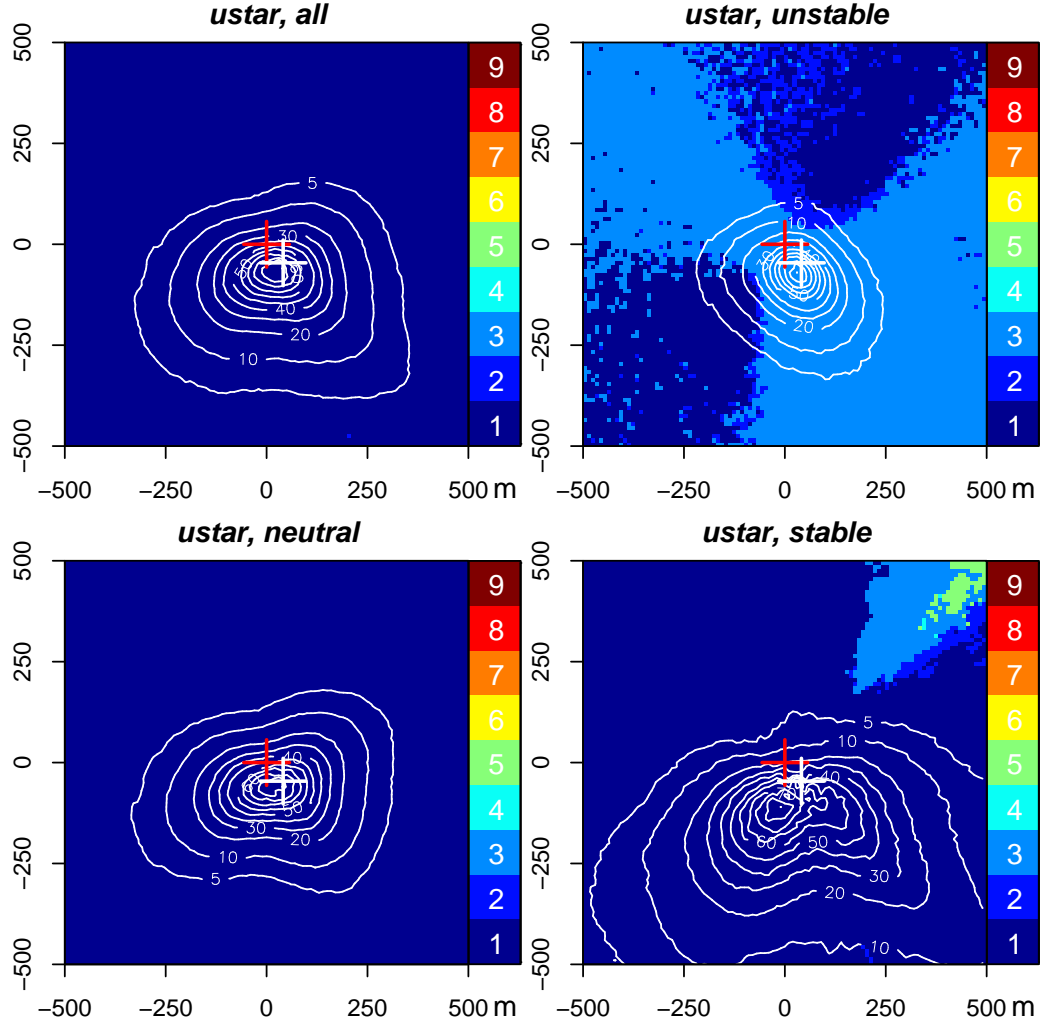


Figure 10: Footprint climatology and spatial quality flag features for **friction velocity, EGER IOP1, turbulence tower**, for four classes of atmospheric stratification. White isolines show the relative flux contribution of the corresponding footprint area in 10 % intervals. The outermost isoline indicates the area where 95 % of the flux is coming from. Quality flags of the flux from 1 to 9 are color coded. The red cross indicates the position of the main tower, the white cross the position of the turbulence tower. The plot is a map projection. X- and y-axis are distances in meters.

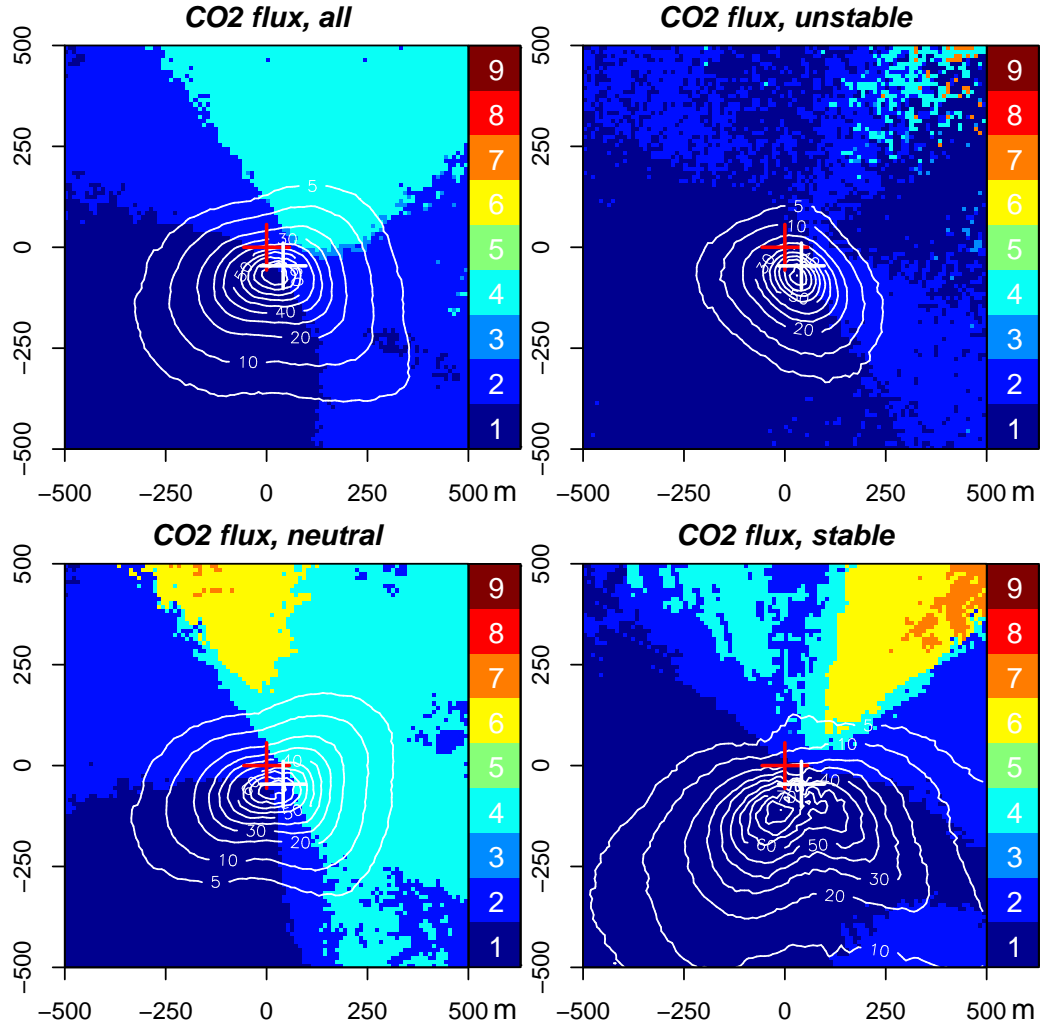


Figure 11: Footprint climatology and spatial quality flag features for the **CO₂ flux, EGER IOP1, turbulence tower**, for four classes of atmospheric stratification. White isolines show the relative flux contribution of the corresponding footprint area in 10 % intervals. The outermost isoline indicates the area where 95 % of the flux is coming from. Quality flags of the flux from 1 to 9 are color coded. The red cross indicates the position of the main tower, the white cross the position of the turbulence tower. The plot is a map projection. X- and y-axis are distances in meters.

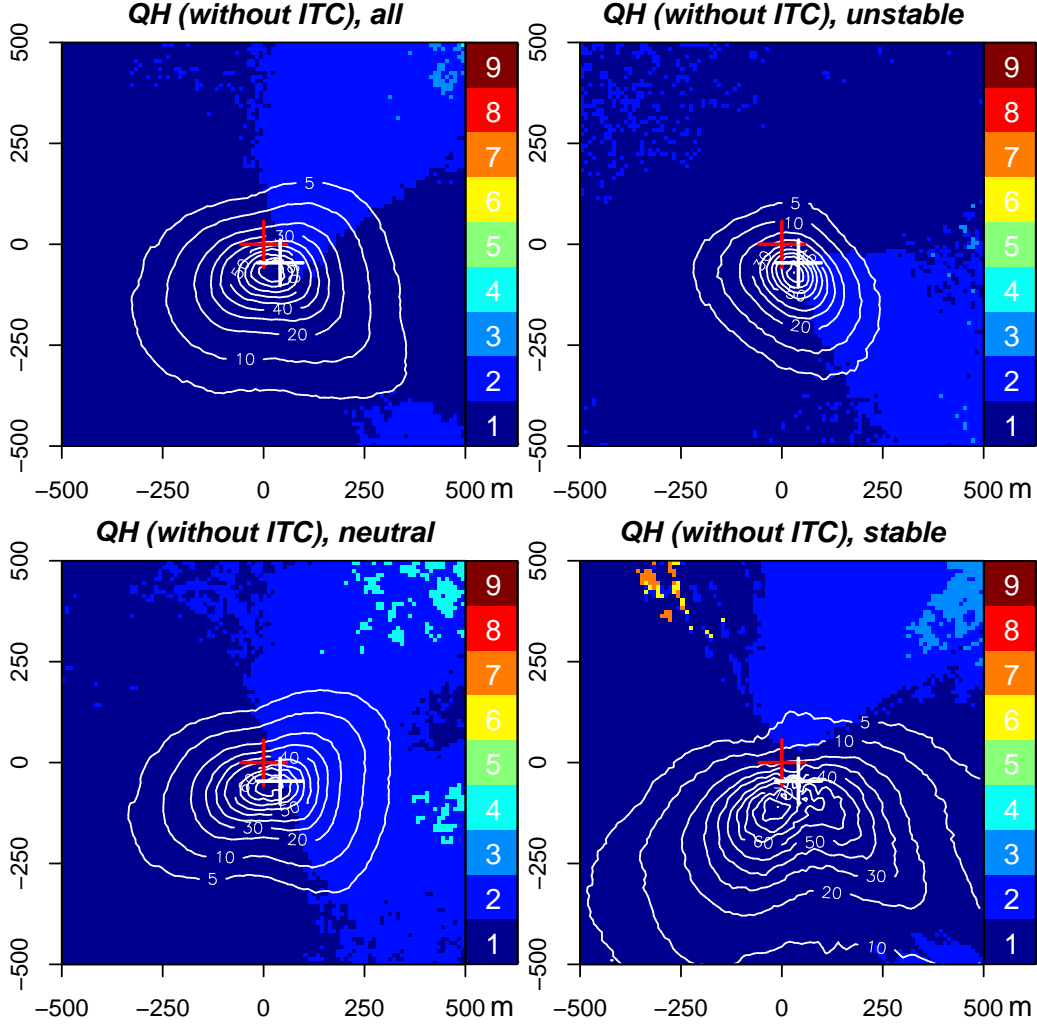


Figure 12: Footprint climatology and spatial quality flag features for the **sensible heat flux, EGER IOP1, turbulence tower**, for four classes of atmospheric stratification. White isolines show the relative flux contribution of the corresponding footprint area in 10 % intervals. The outermost isoline indicates the area where 95 % of the flux is coming from. Quality flags of the flux from 1 to 9 are color coded. The red cross indicates the position of the main tower, the white cross the position of the turbulence tower. The plot is a map projection. X- and y-axis are distances in meters.

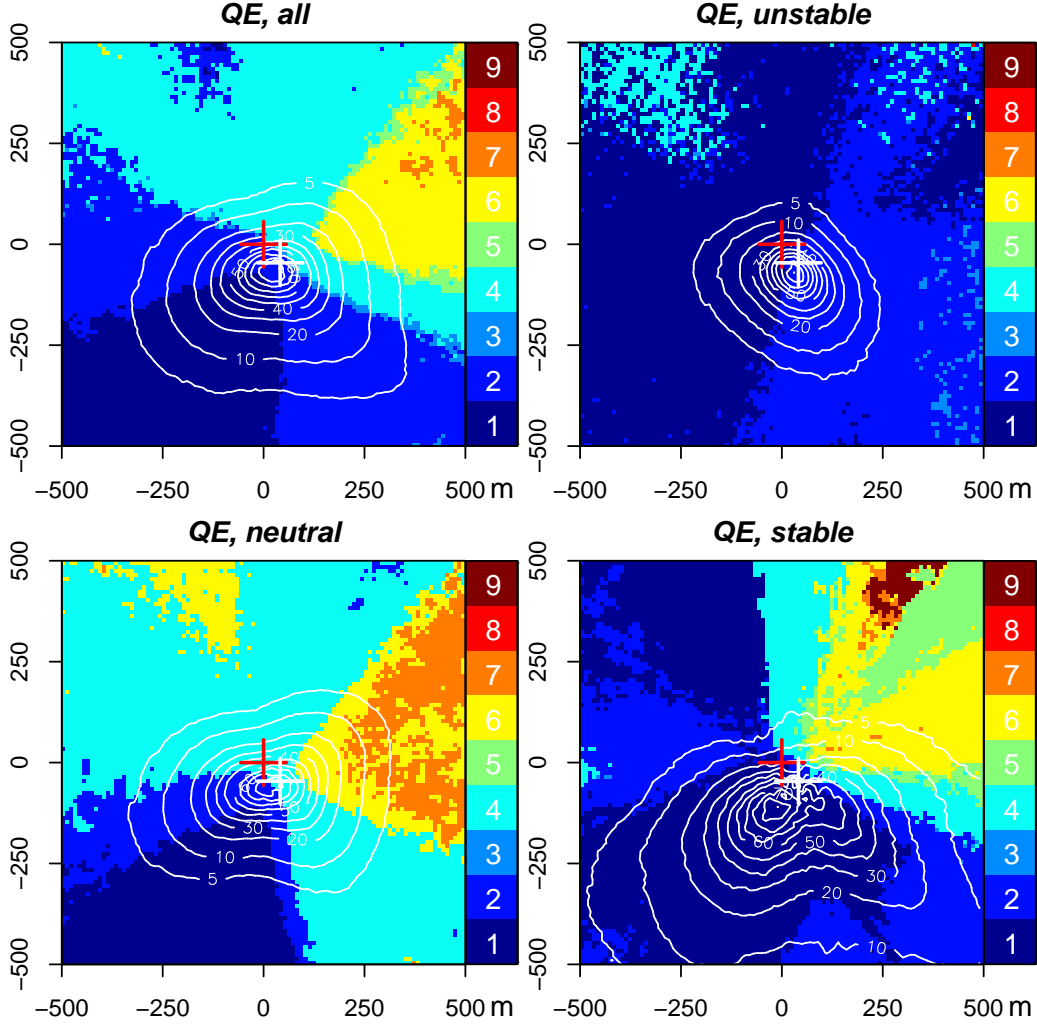


Figure 13: Footprint climatology and spatial quality flag features for the **latent heat flux, EGER IOP1, turbulence tower**, for four classes of atmospheric stratification. White isolines show the relative flux contribution of the corresponding footprint area in 10 % intervals. The outermost isoline indicates the area where 95 % of the flux is coming from. Quality flags of the flux from 1 to 9 are color coded. The red cross indicates the position of the main tower, the white cross the position of the turbulence tower. The plot is a map projection. X- and y-axis are distances in meters.

3.4 Land use fractions - turbulence tower

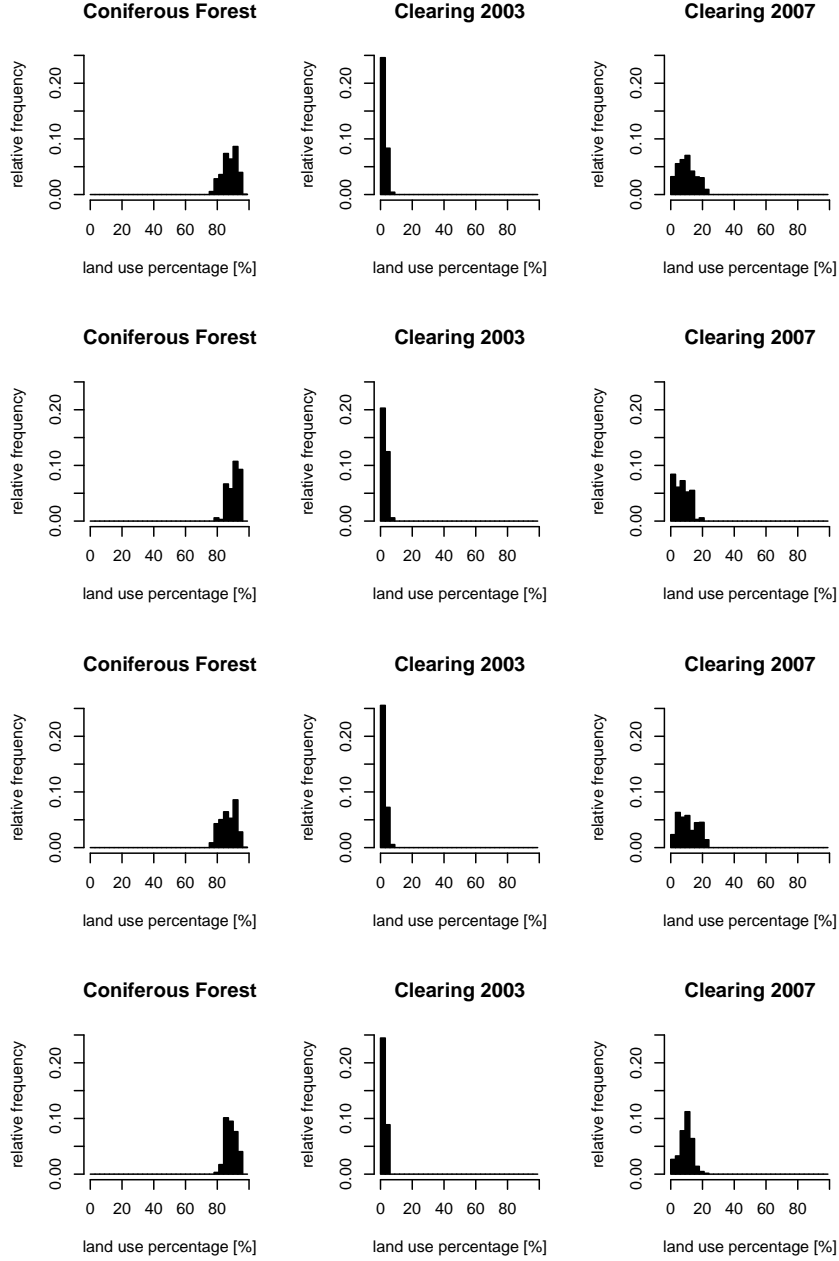


Figure 14: Relative contribution of different land use classes to the flux, **EGER IOP1, turbulence tower**, for four classes of atmospheric stratification: all stratifications (top panel), unstable (second panel from top), neutral (third panel from top) and stable (bottom panel).

4 Results for EGER IOP2 2008

4.1 Footprint synthesis - main tower

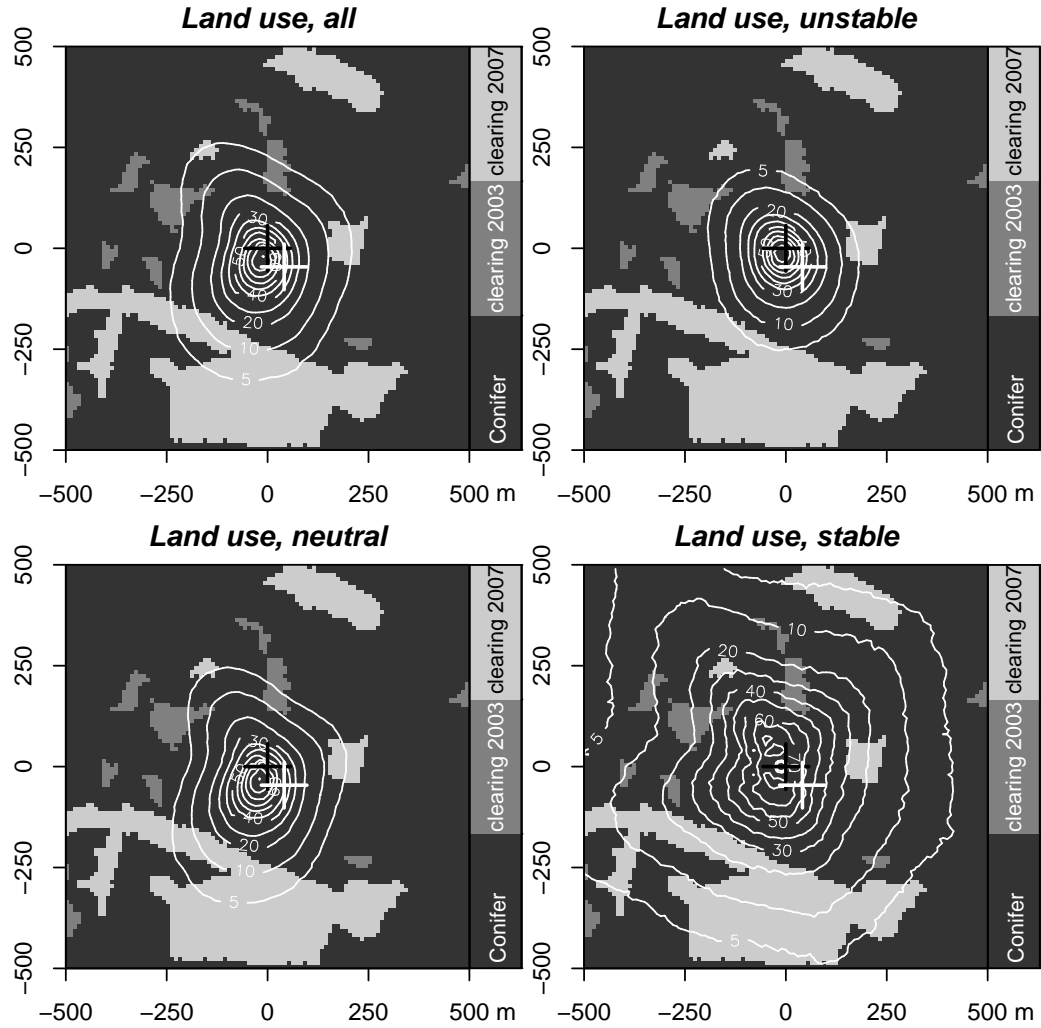


Figure 15: Footprint climatology over land use map, EGER IOP2, main tower, for four classes of atmospheric stratification. White isolines show the relative flux contribution of the corresponding footprint area in 10 % intervals. The outermost isoline indicates the area where 95 % of the flux is coming from. The black cross indicates the position of the main tower, the white cross the position of the turbulence tower. The plot is a map projection. X- and y-axis are distances in meters.

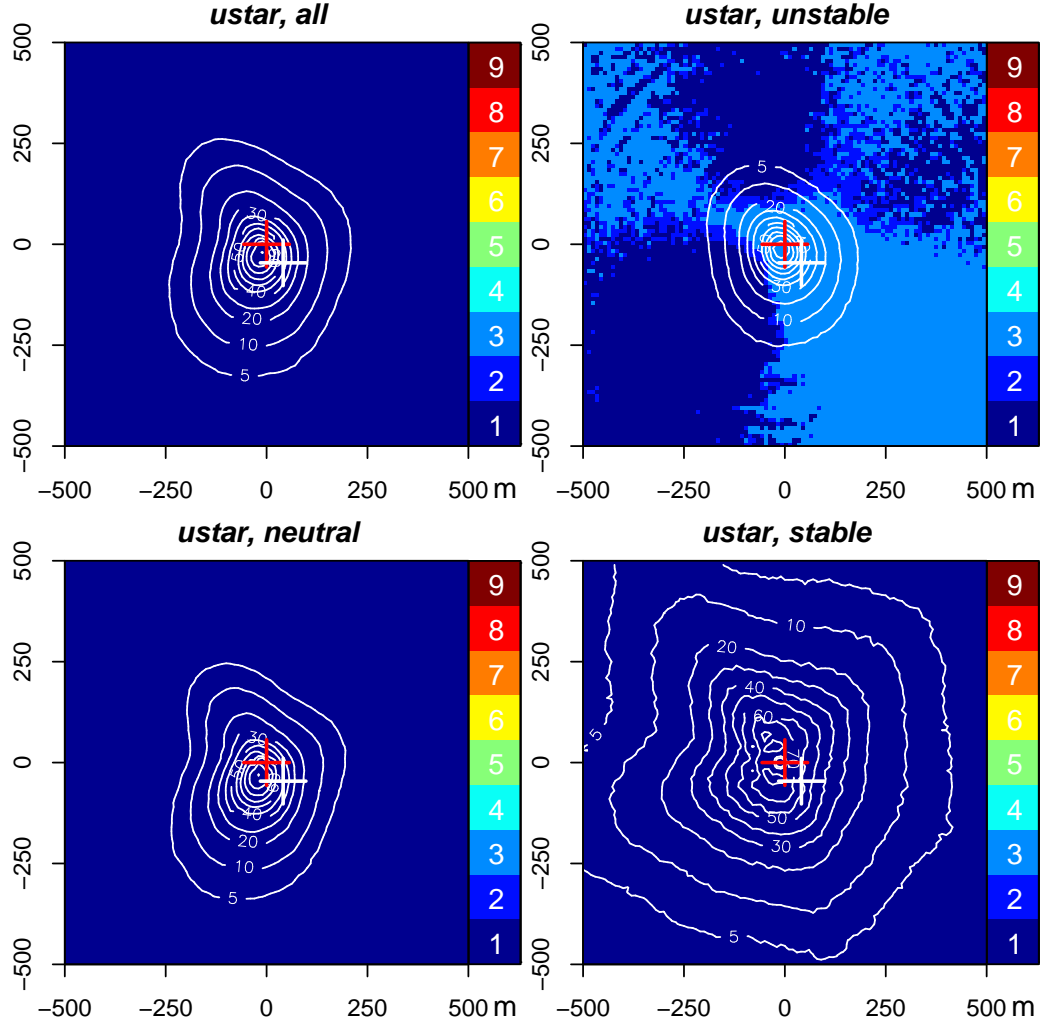


Figure 16: Footprint climatology and spatial quality flag features for **friction velocity, EGER IOP2, main tower**, for four classes of atmospheric stratification. White isolines show the relative flux contribution of the corresponding footprint area in 10 % intervals. The outermost isoline indicates the area where 95 % of the flux is coming from. Quality flags of the flux from 1 to 9 are color coded. The red cross indicates the position of the main tower, the white cross the position of the turbulence tower. The plot is a map projection. X- and y-axis are distances in meters.

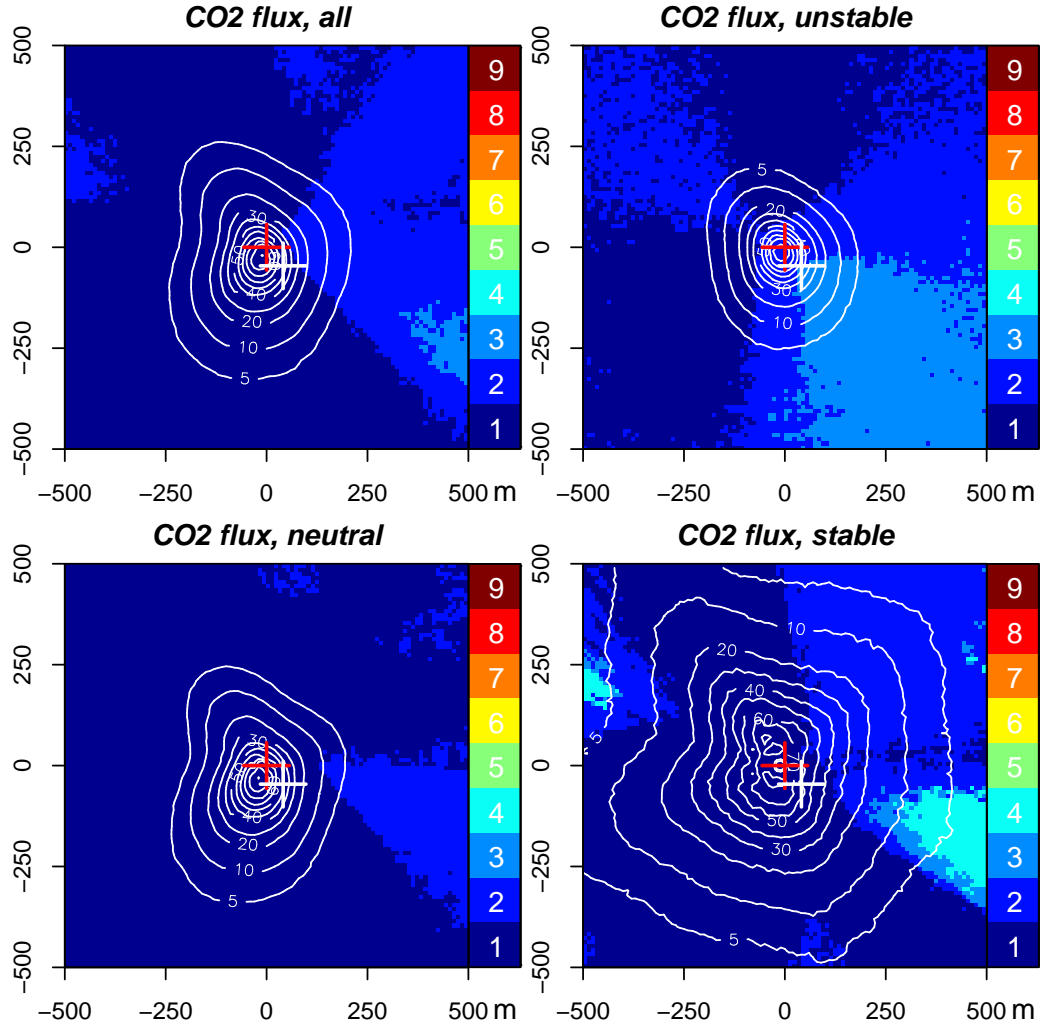


Figure 17: Footprint climatology and spatial quality flag features for the **CO₂ flux, EGER IOP2, main tower**, for four classes of atmospheric stratification. White isolines show the relative flux contribution of the corresponding footprint area in 10 % intervals. The outermost isoline indicates the area where 95 % of the flux is coming from. Quality flags of the flux from 1 to 9 are color coded. The red cross indicates the position of the main tower, the white cross the position of the turbulence tower. The plot is a map projection. X- and y-axis are distances in meters.

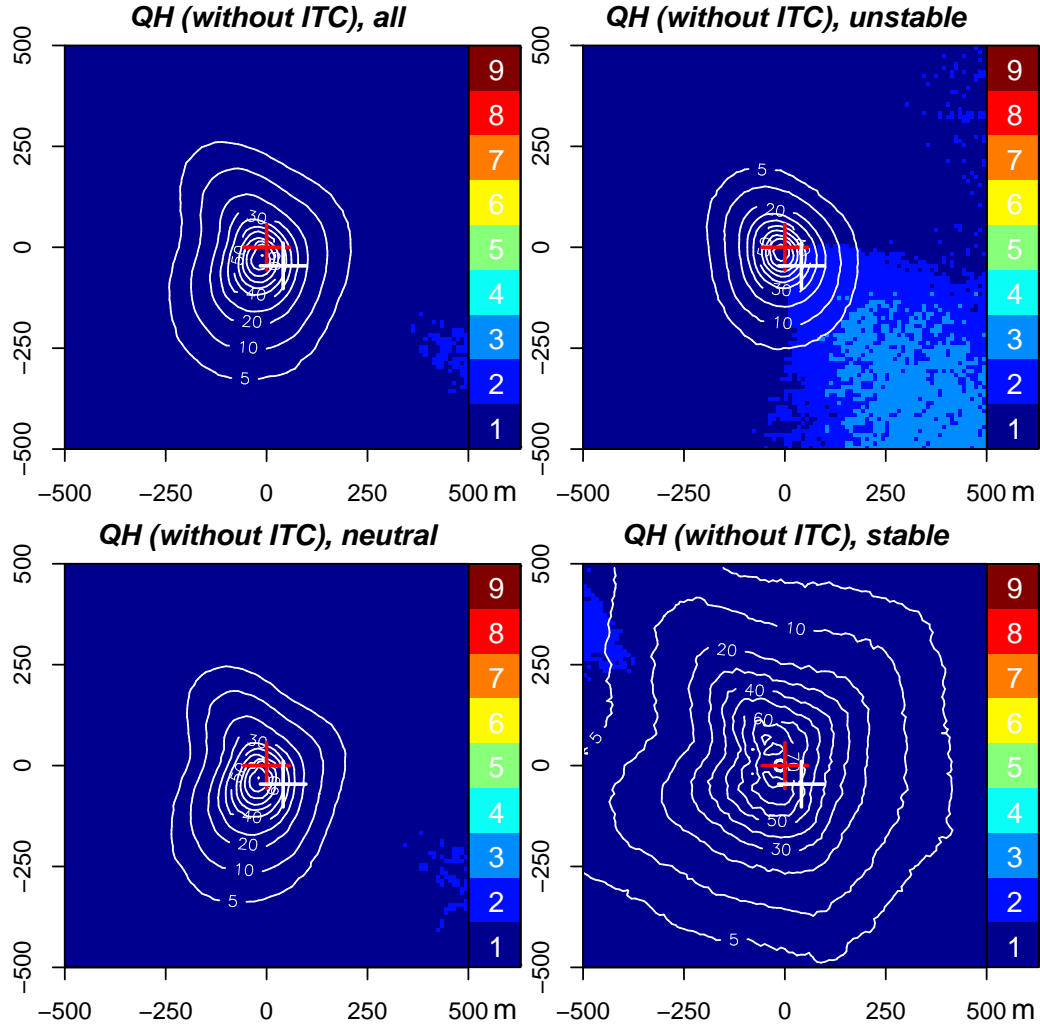


Figure 18: Footprint climatology and spatial quality flag features for the **sensible heat flux, EGER IOP2, main tower**, for four classes of atmospheric stratification. White isolines show the relative flux contribution of the corresponding footprint area in 10 % intervals. The outermost isoline indicates the area where 95 % of the flux is coming from. Quality flags of the flux from 1 to 9 are color coded. The red cross indicates the position of the main tower, the white cross the position of the turbulence tower. The plot is a map projection. X- and y-axis are distances in meters.

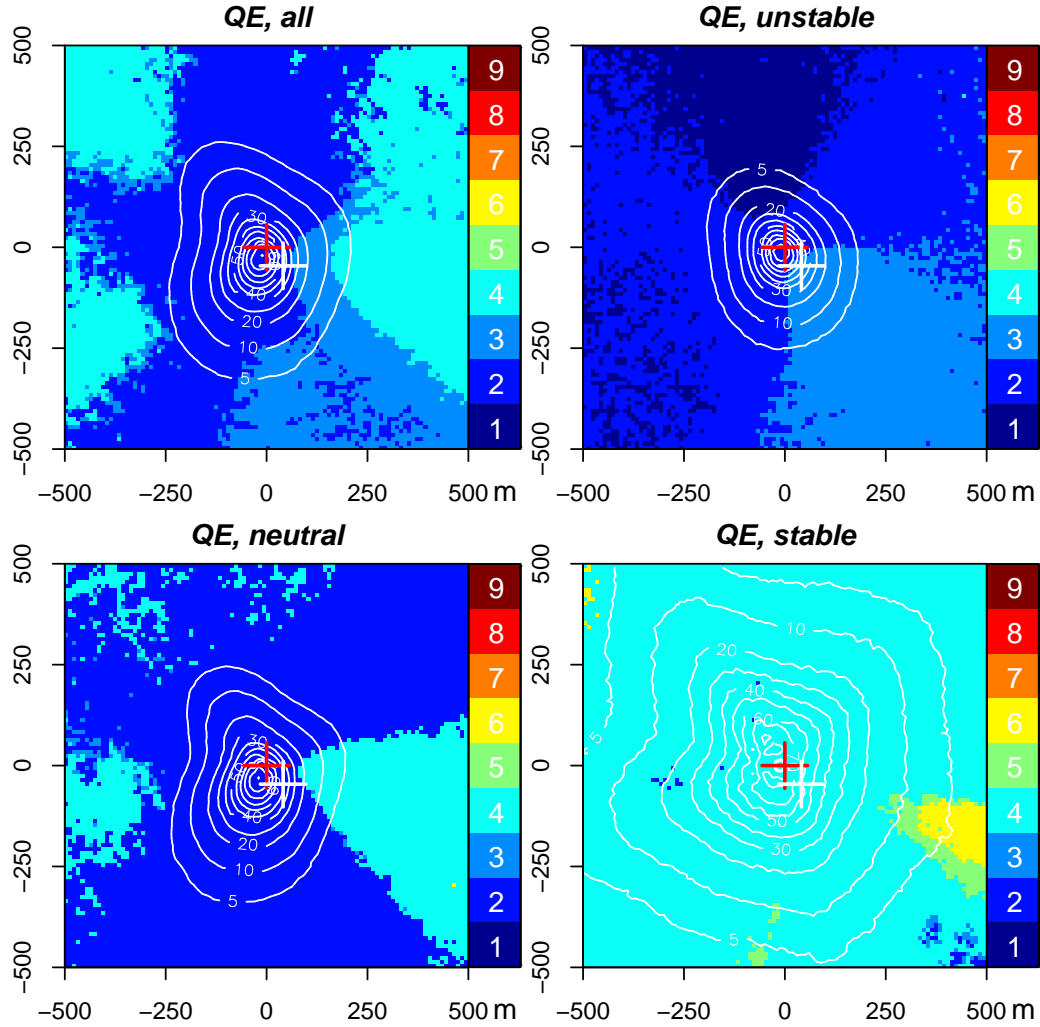


Figure 19: Footprint climatology and spatial quality flag features for the **latent heat flux, EGER IOP2, main tower**, for four classes of atmospheric stratification. White isolines show the relative flux contribution of the corresponding footprint area in 10 % intervals. The outermost isoline indicates the area where 95 % of the flux is coming from. Quality flags of the flux from 1 to 9 are color coded. The red cross indicates the position of the main tower, the white cross the position of the turbulence tower. The plot is a map projection. X- and y-axis are distances in meters.

4.2 Land use fractions - main tower

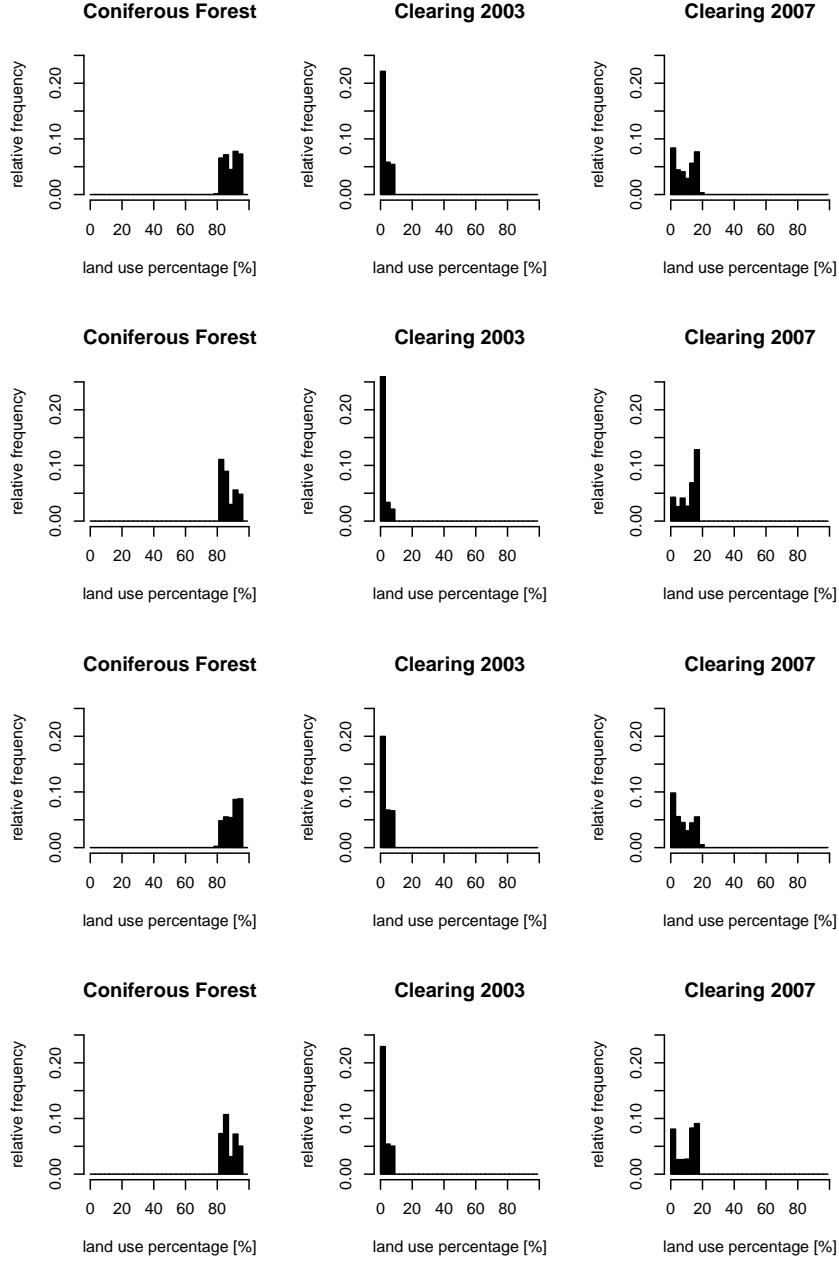


Figure 20: Relative contribution of different land use classes to the flux, **EGER IOP2, main tower**, for four classes of atmospheric stratification: all stratifications (top panel), unstable (second panel from top), neutral (third panel from top) and stable (bottom panel).

4.3 Footprint synthesis - turbulence tower

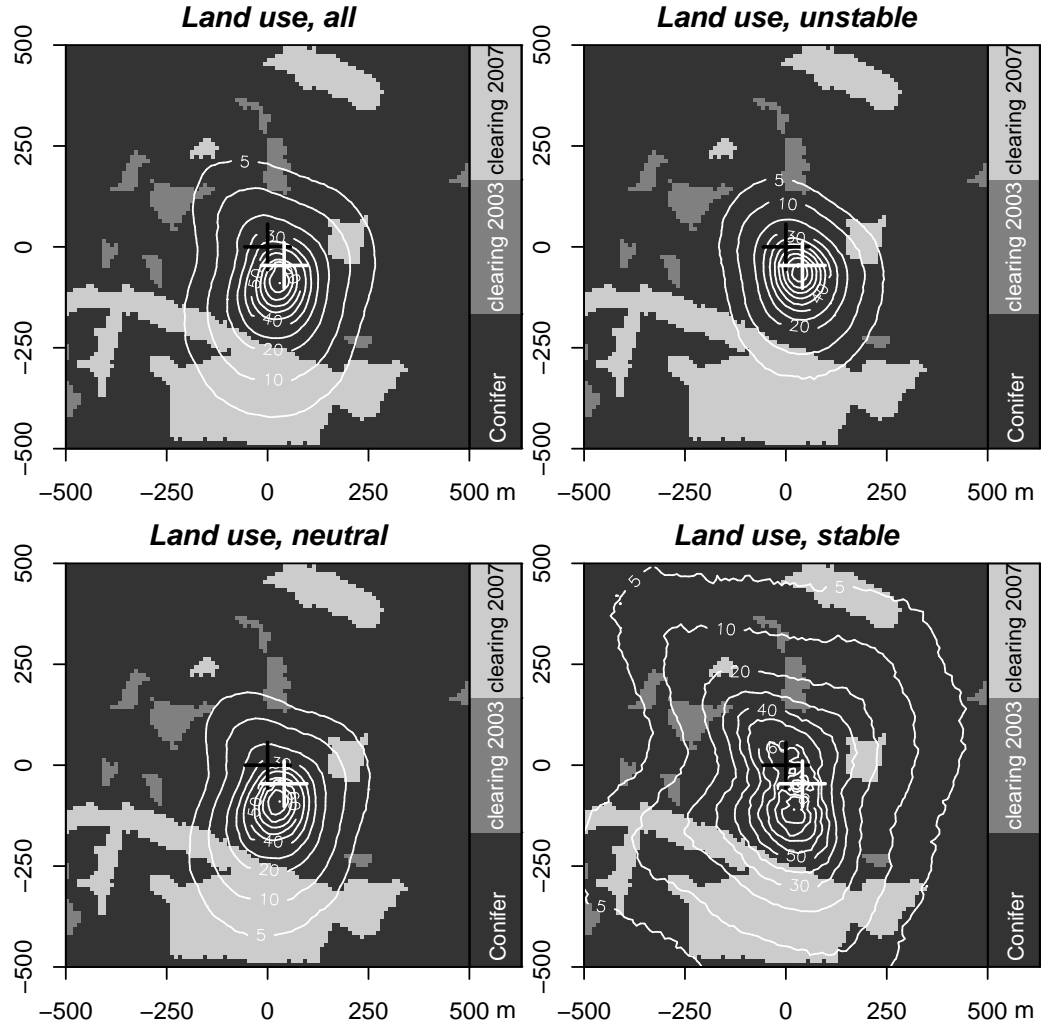


Figure 21: Footprint climatology over land use map, EGER IOP2, turbulence tower, for four classes of atmospheric stratification. White isolines show the relative flux contribution of the corresponding footprint area in 10 % intervals. The outermost isoline indicates the area where 95 % of the flux is coming from. The black cross indicates the position of the main tower, the white cross the position of the turbulence tower. The plot is a map projection. X- and y-axis are distances in meters.

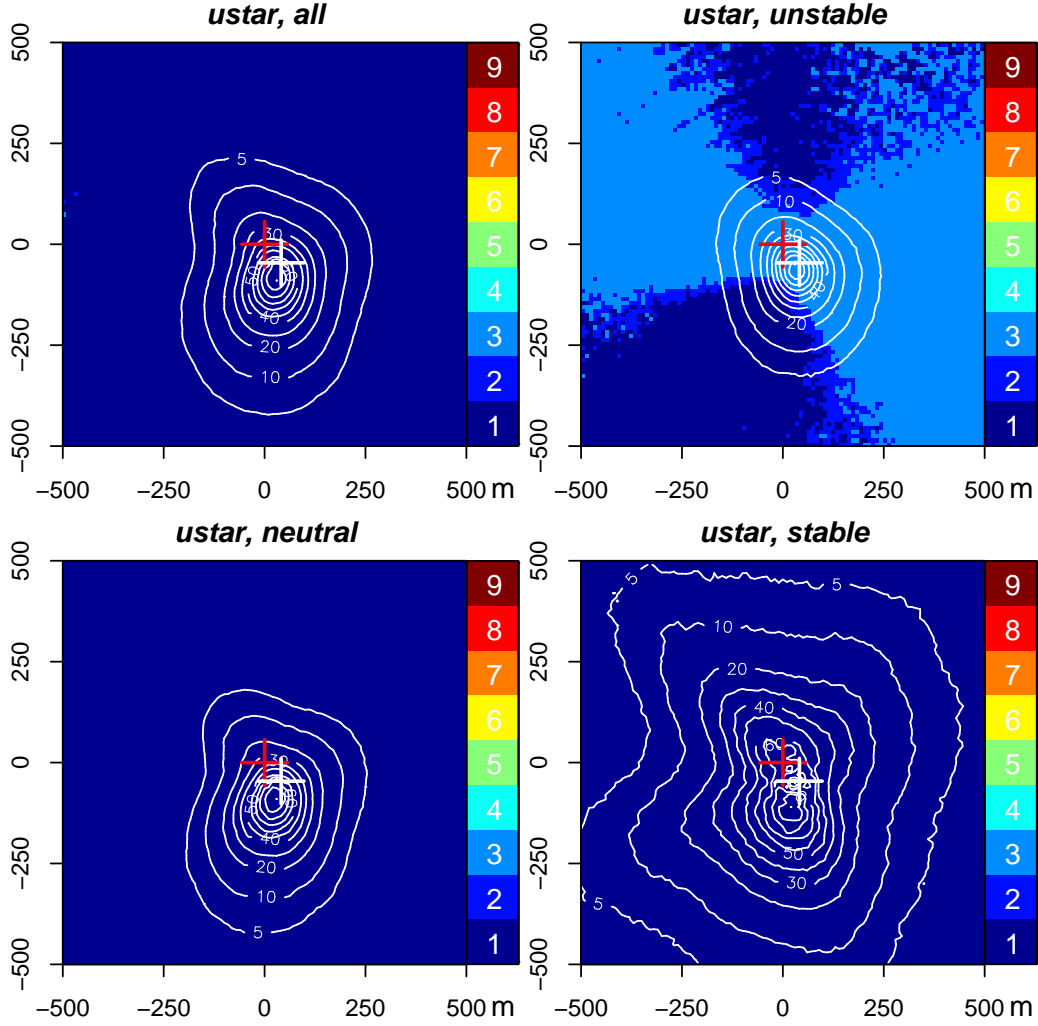


Figure 22: Footprint climatology and spatial quality flag features for **friction velocity, EGER IOP2, turbulence tower**, for four classes of atmospheric stratification. White isolines show the relative flux contribution of the corresponding footprint area in 10 % intervals. The outermost isoline indicates the area where 95 % of the flux is coming from. Quality flags of the flux from 1 to 9 are color coded. The red cross indicates the position of the main tower, the white cross the position of the turbulence tower. The plot is a map projection. X- and y-axis are distances in meters.

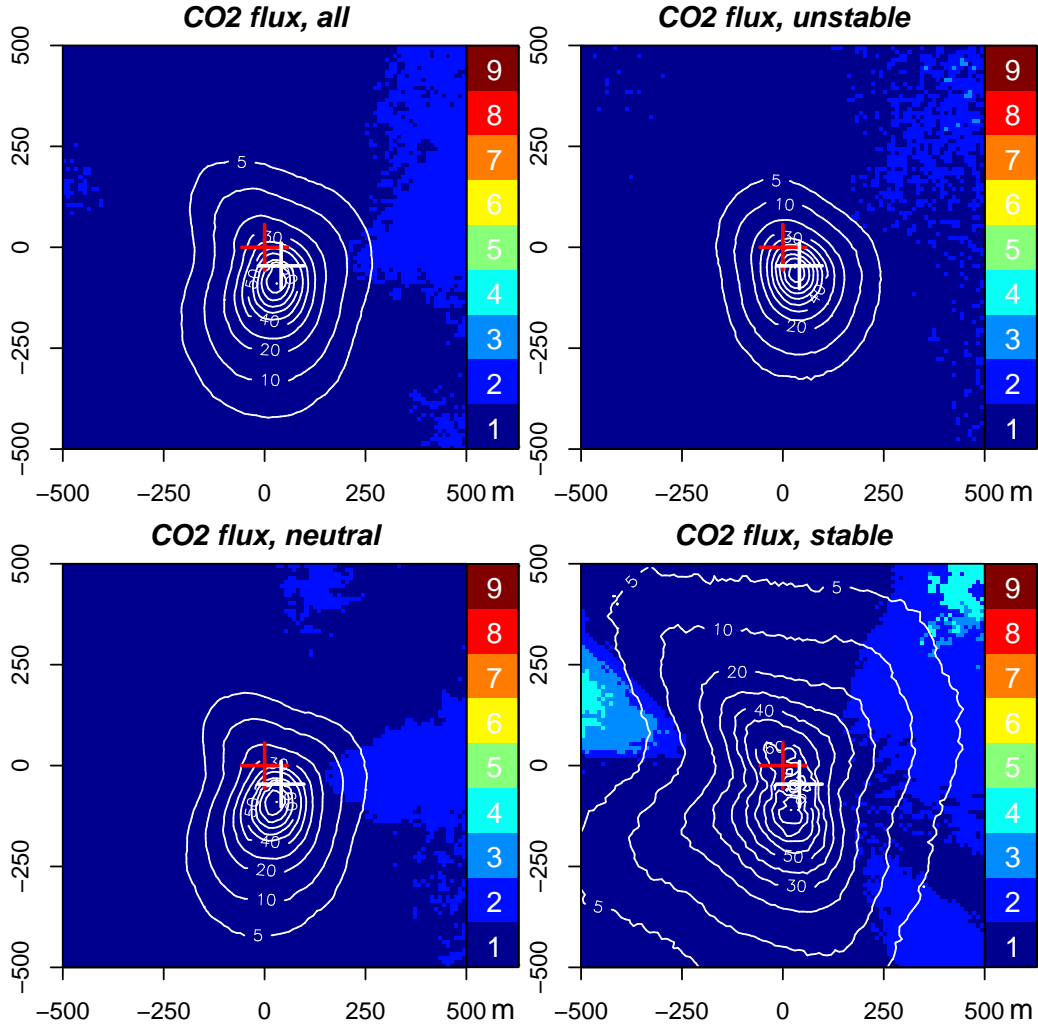


Figure 23: Footprint climatology and spatial quality flag features for the CO_2 flux, EGER IOP2, turbulence tower, for four classes of atmospheric stratification. White isolines show the relative flux contribution of the corresponding footprint area in 10 % intervals. The outermost isoline indicates the area where 95 % of the flux is coming from. Quality flags of the flux from 1 to 9 are color coded. The red cross indicates the position of the main tower, the white cross the position of the turbulence tower. The plot is a map projection. X- and y-axis are distances in meters.

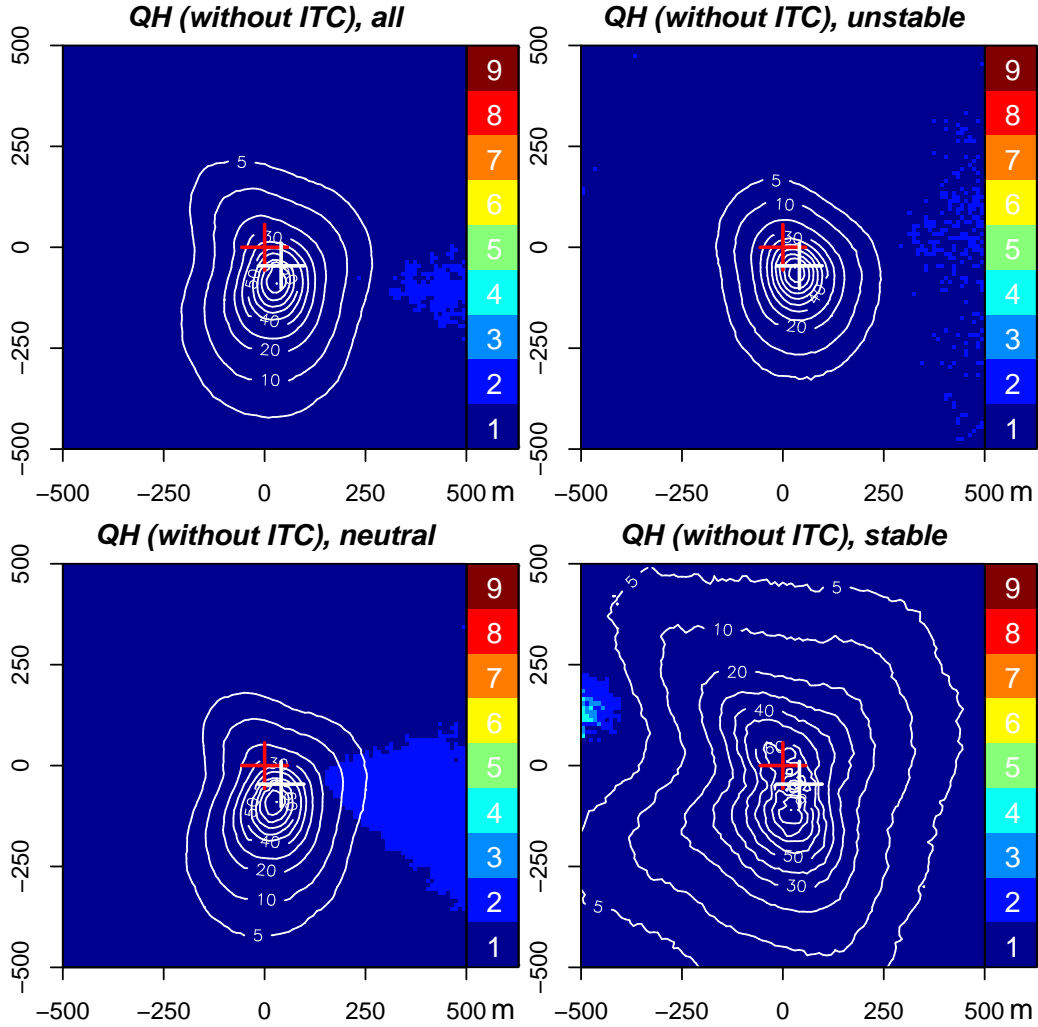


Figure 24: Footprint climatology and spatial quality flag features for the **sensible heat flux, EGER IOP2, turbulence tower**, for four classes of atmospheric stratification. White isolines show the relative flux contribution of the corresponding footprint area in 10 % intervals. The outermost isoline indicates the area where 95 % of the flux is coming from. Quality flags of the flux from 1 to 9 are color coded. The red cross indicates the position of the main tower, the white cross the position of the turbulence tower. The plot is a map projection. X- and y-axis are distances in meters.

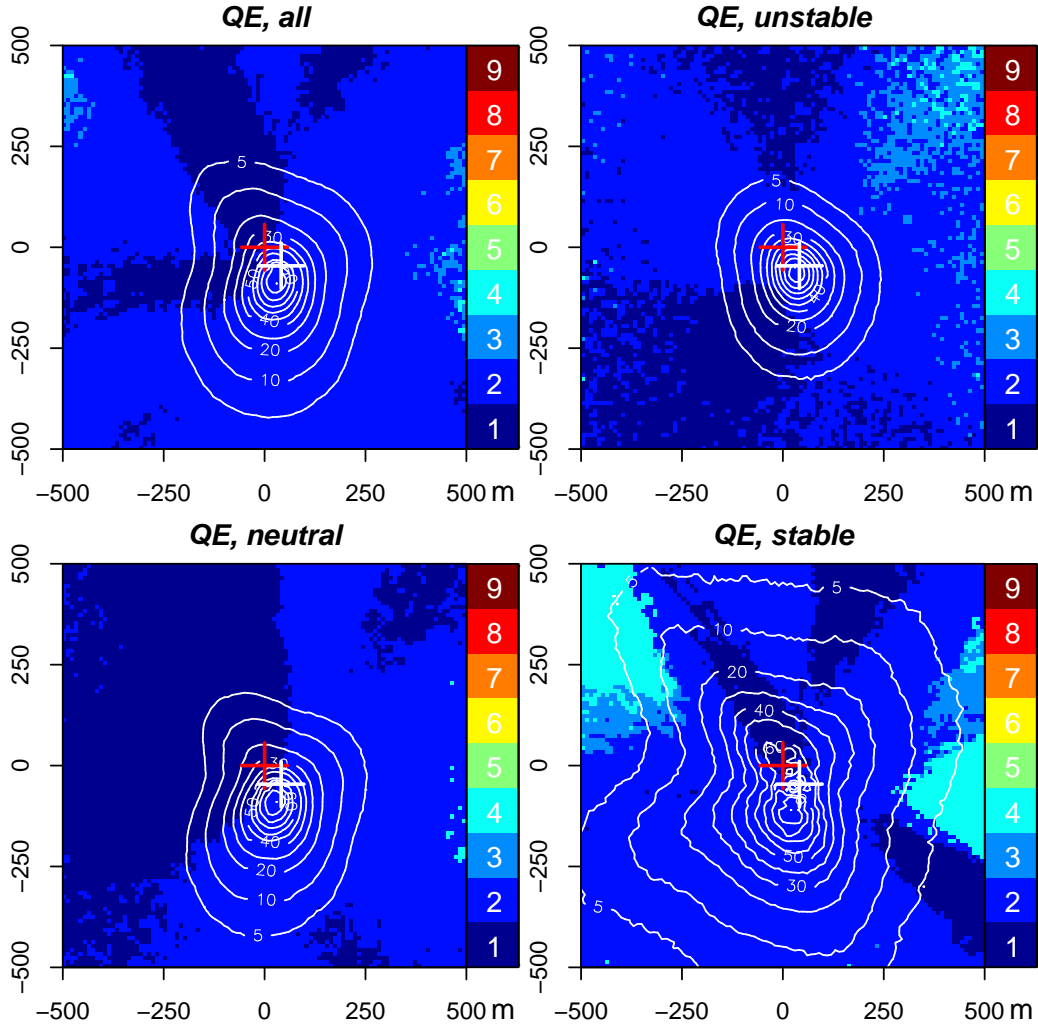


Figure 25: Footprint climatology and spatial quality flag features for the **latent heat flux, EGER IOP2, turbulence tower**, for four classes of atmospheric stratification. White isolines show the relative flux contribution of the corresponding footprint area in 10 % intervals. The outermost isoline indicates the area where 95 % of the flux is coming from. Quality flags of the flux from 1 to 9 are color coded. The red cross indicates the position of the main tower, the white cross the position of the turbulence tower. The plot is a map projection. X- and y-axis are distances in meters.

4.4 Land use fractions - turbulence tower

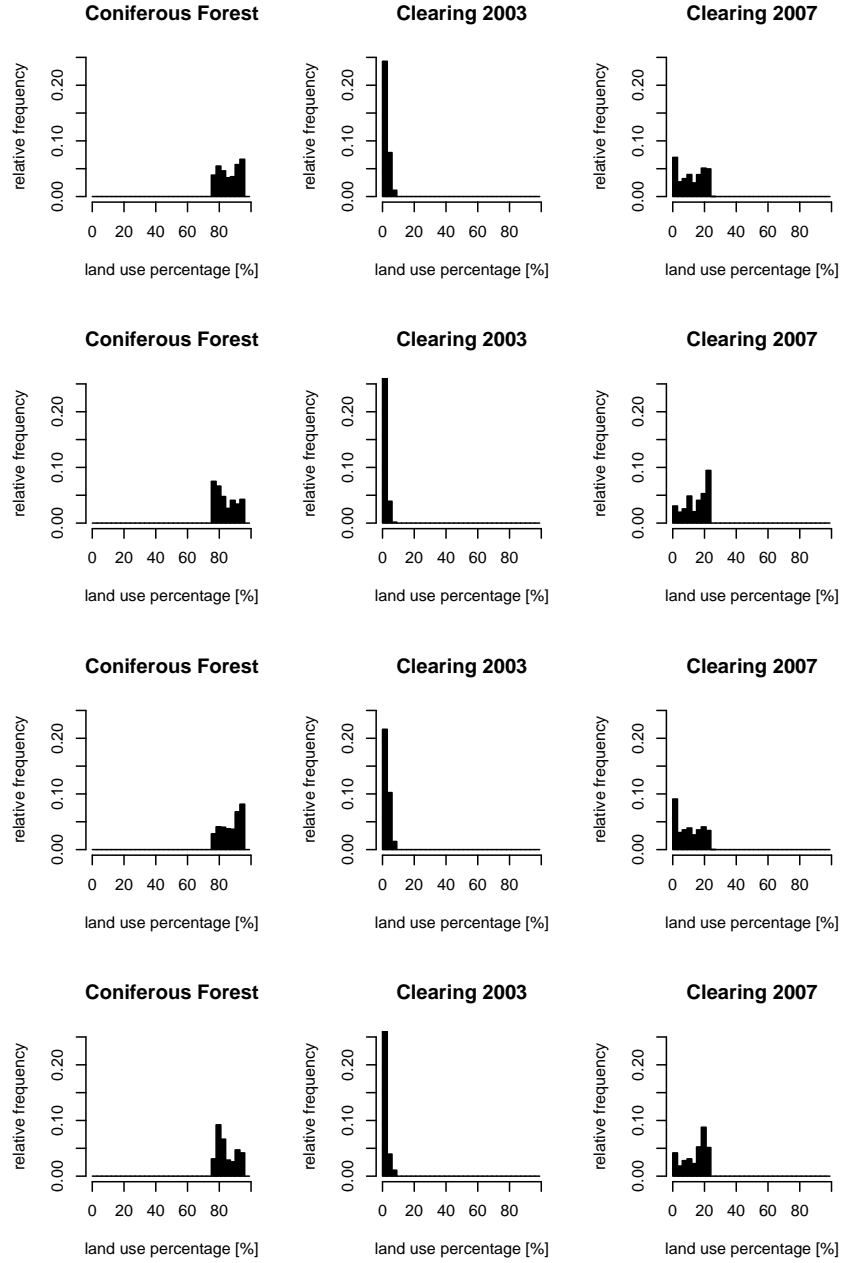


Figure 26: Relative contribution of different land use classes to the flux, **EGER IOP2, turbulence tower**, for four classes of atmospheric stratification: all stratifications (top panel), unstable (second panel from top), neutral (third panel from top) and stable (bottom panel).

5 Results for EGER IOP2 (extended) 2008

5.1 Footprint synthesis - turbulence tower

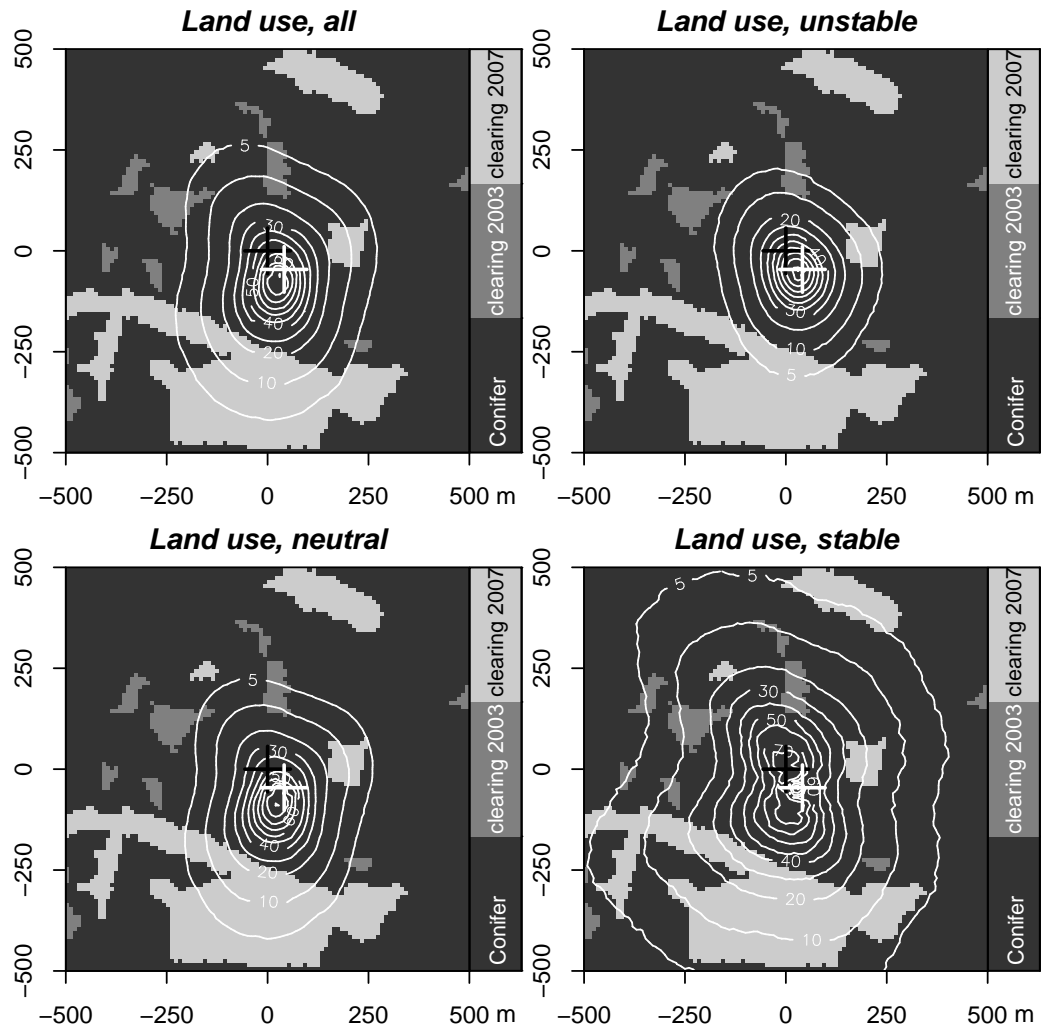


Figure 27: Footprint climatology over land use map, EGER IOP2 extended, turbulence tower, for four classes of atmospheric stratification. White isolines show the relative flux contribution of the corresponding footprint area in 10 % intervals. The outermost isoline indicates the area where 95 % of the flux is coming from. The black cross indicates the position of the main tower, the white cross the position of the turbulence tower. The plot is a map projection. X- and y-axis are distances in meters.

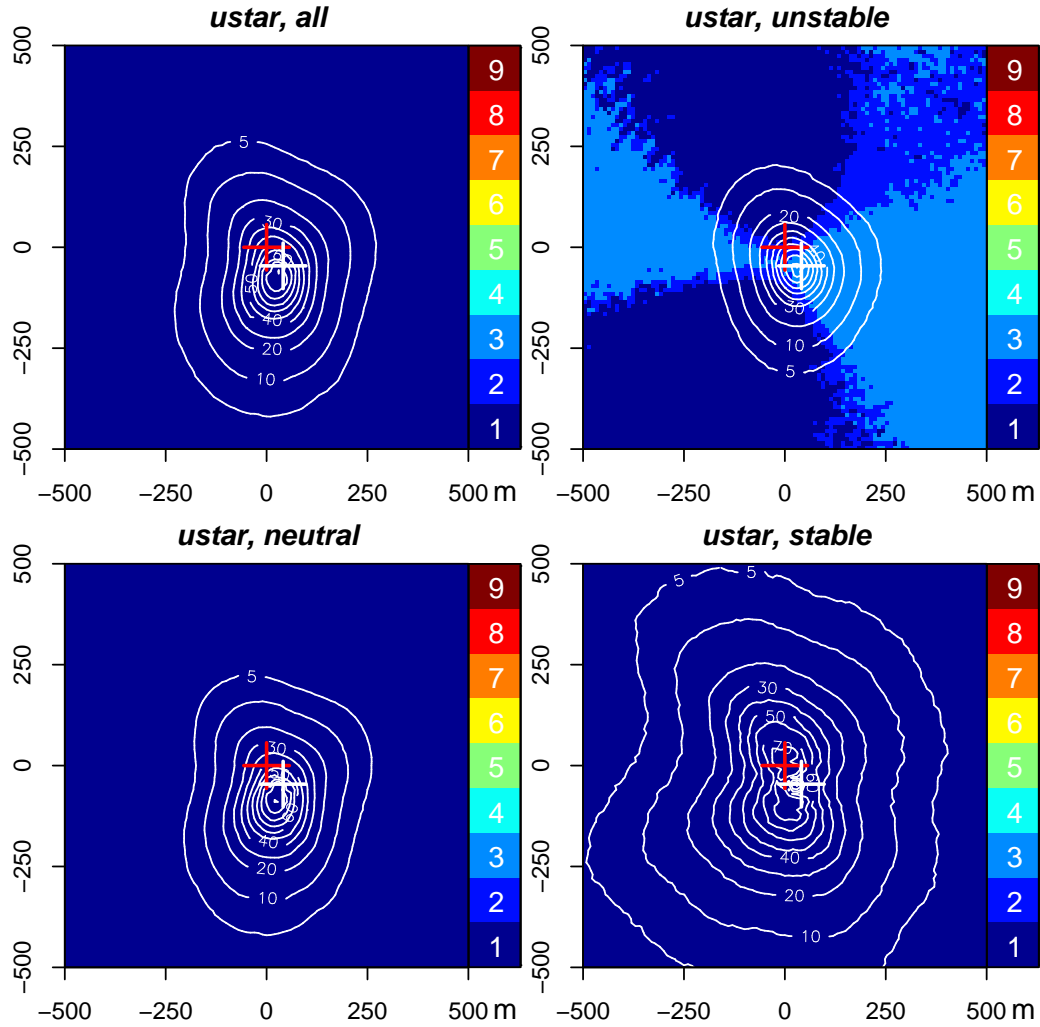


Figure 28: Footprint climatology and spatial quality flag features for **friction velocity, EGER IOP2 (extended), turbulence tower**, for four classes of atmospheric stratification. White isolines show the relative flux contribution of the corresponding footprint area in 10 % intervals. The outermost isoline indicates the area where 95 % of the flux is coming from. Quality flags of the flux from 1 to 9 are color coded. The red cross indicates the position of the main tower, the white cross the position of the turbulence tower. The plot is a map projection. X- and y-axis are distances in meters.

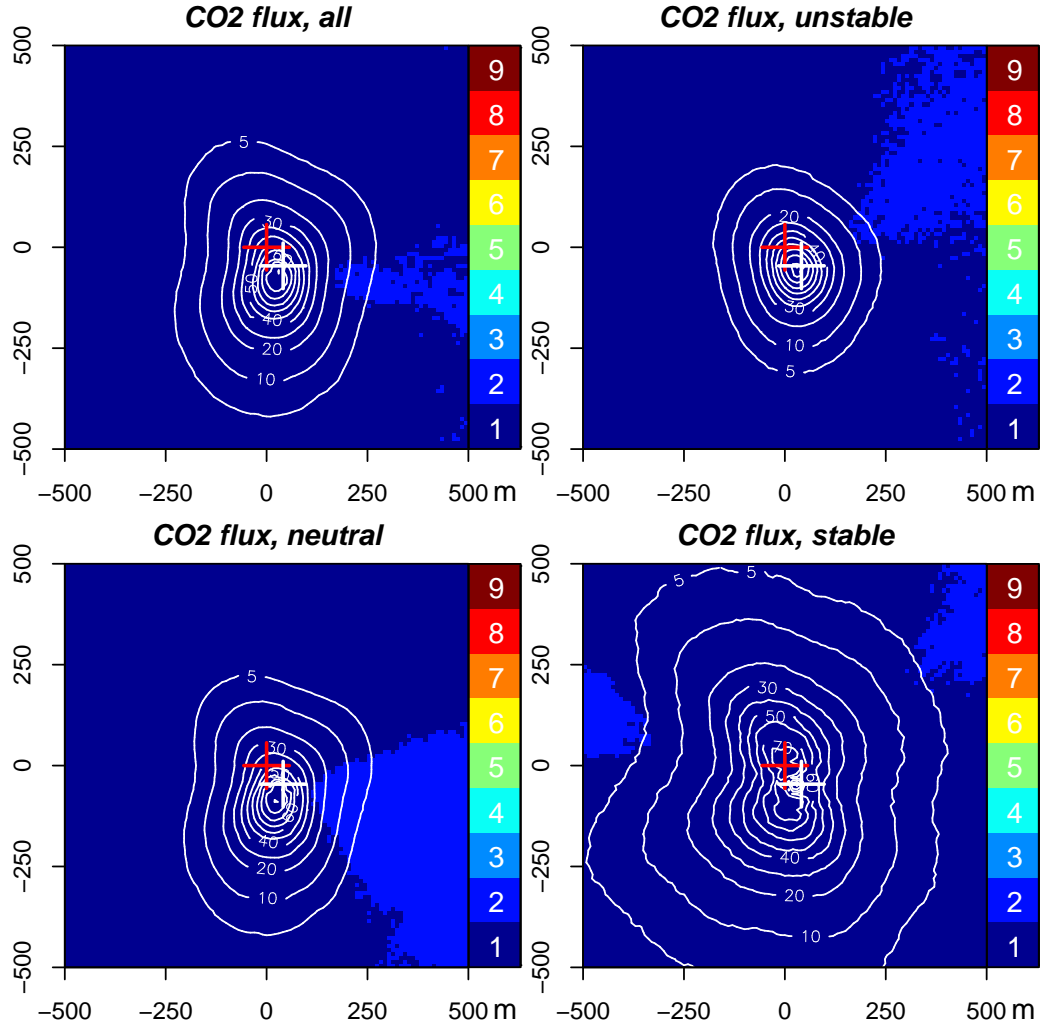


Figure 29: Footprint climatology and spatial quality flag features for the CO_2 flux, EGER IOP2 (extended), turbulence tower, for four classes of atmospheric stratification. White isolines show the relative flux contribution of the corresponding footprint area in 10 % intervals. The outermost isoline indicates the area where 95 % of the flux is coming from. Quality flags of the flux from 1 to 9 are color coded. The red cross indicates the position of the main tower, the white cross the position of the turbulence tower. The plot is a map projection. X- and y-axis are distances in meters.

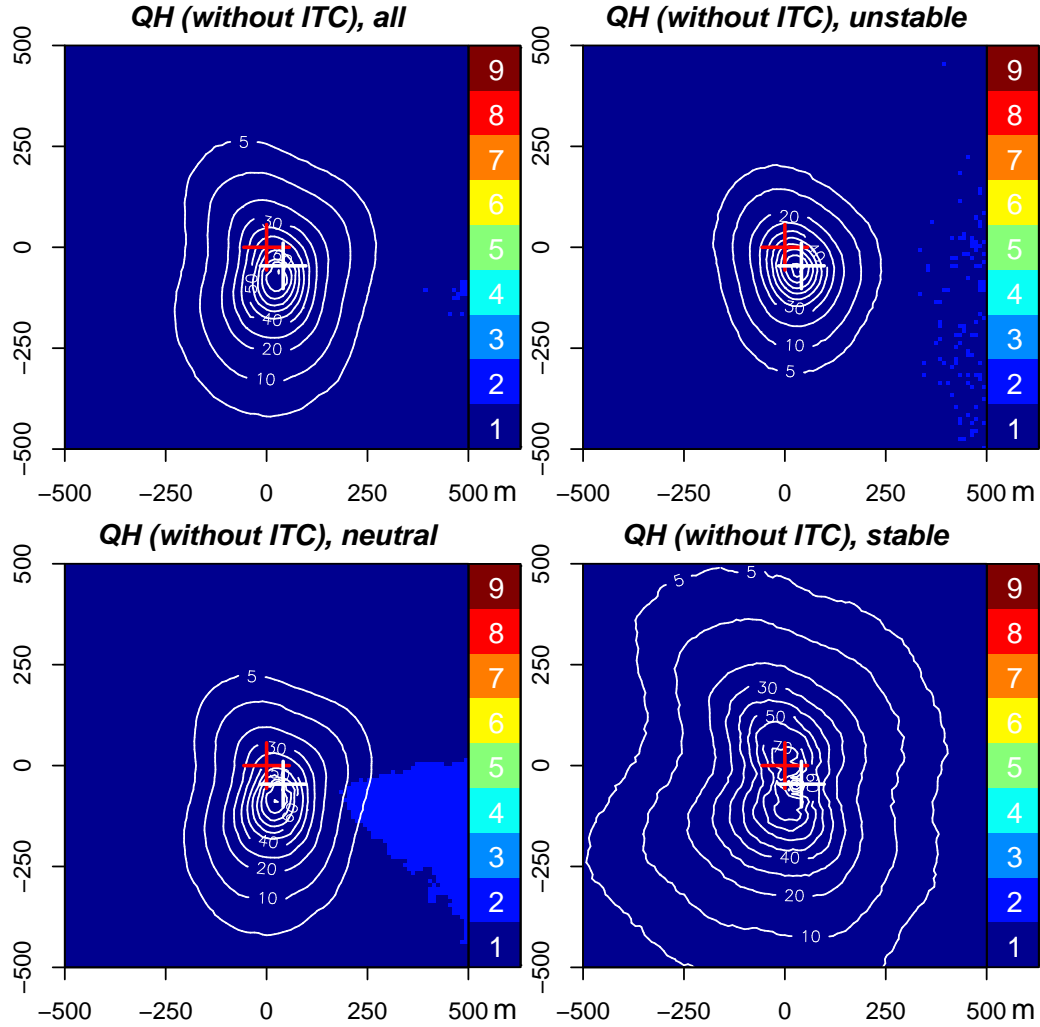


Figure 30: Footprint climatology and spatial quality flag features for the **sensible heat flux, EGER IOP2 (extended), turbulence tower**, for four classes of atmospheric stratification. White isolines show the relative flux contribution of the corresponding footprint area in 10 % intervals. The outermost isoline indicates the area where 95 % of the flux is coming from. Quality flags of the flux from 1 to 9 are color coded. The red cross indicates the position of the main tower, the white cross the position of the turbulence tower. The plot is a map projection. X- and y-axis are distances in meters.

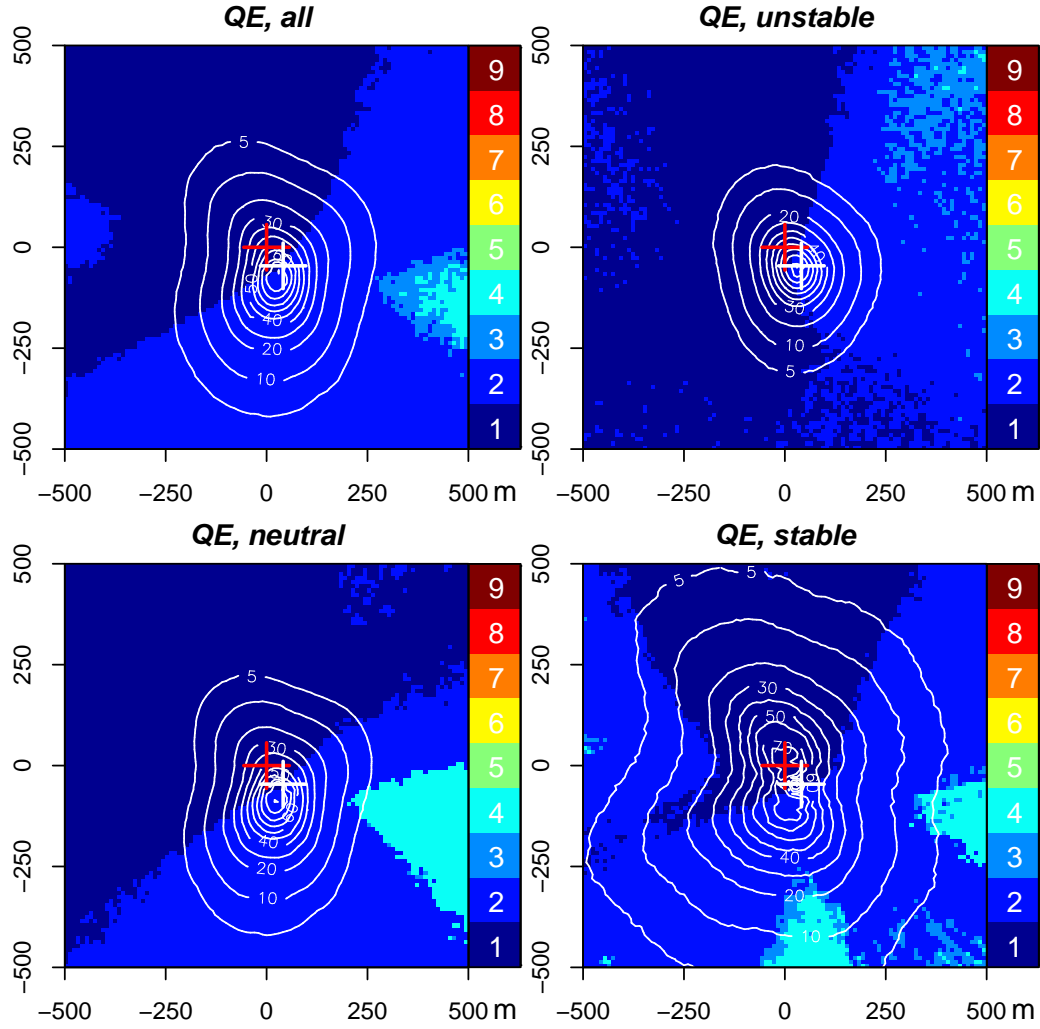


Figure 31: Footprint climatology and spatial quality flag features for the **latent heat flux, EGER IOP2 (extended), turbulence tower**, for four classes of atmospheric stratification. White isolines show the relative flux contribution of the corresponding footprint area in 10 % intervals. The outermost isoline indicates the area where 95 % of the flux is coming from. Quality flags of the flux from 1 to 9 are color coded. The red cross indicates the position of the main tower, the white cross the position of the turbulence tower. The plot is a map projection. X- and y-axis are distances in meters.

5.2 Land use fractions - turbulence tower

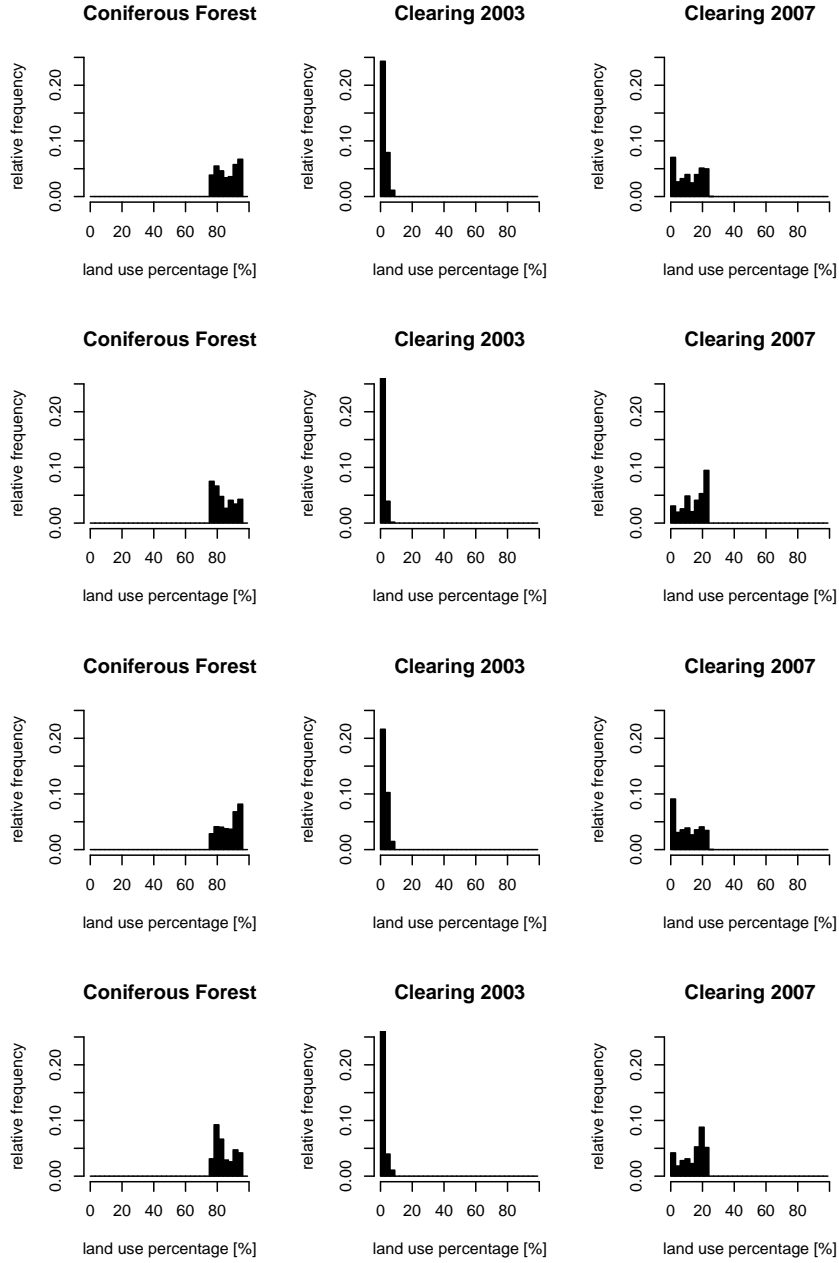


Figure 32: Relative contribution of different land use classes to the flux, **EGER IOP2 (extended), turbulence tower**, for four classes of atmospheric stratification: all stratifications (top panel), unstable (second panel from top), neutral (third panel from top) and stable (bottom panel).

6 Results for WALDATEM 2003

This section shows the footprint analysis for the time before the storm according to Göckede et al. (2005) for comparison purposes.

6.1 Footprint synthesis - main tower

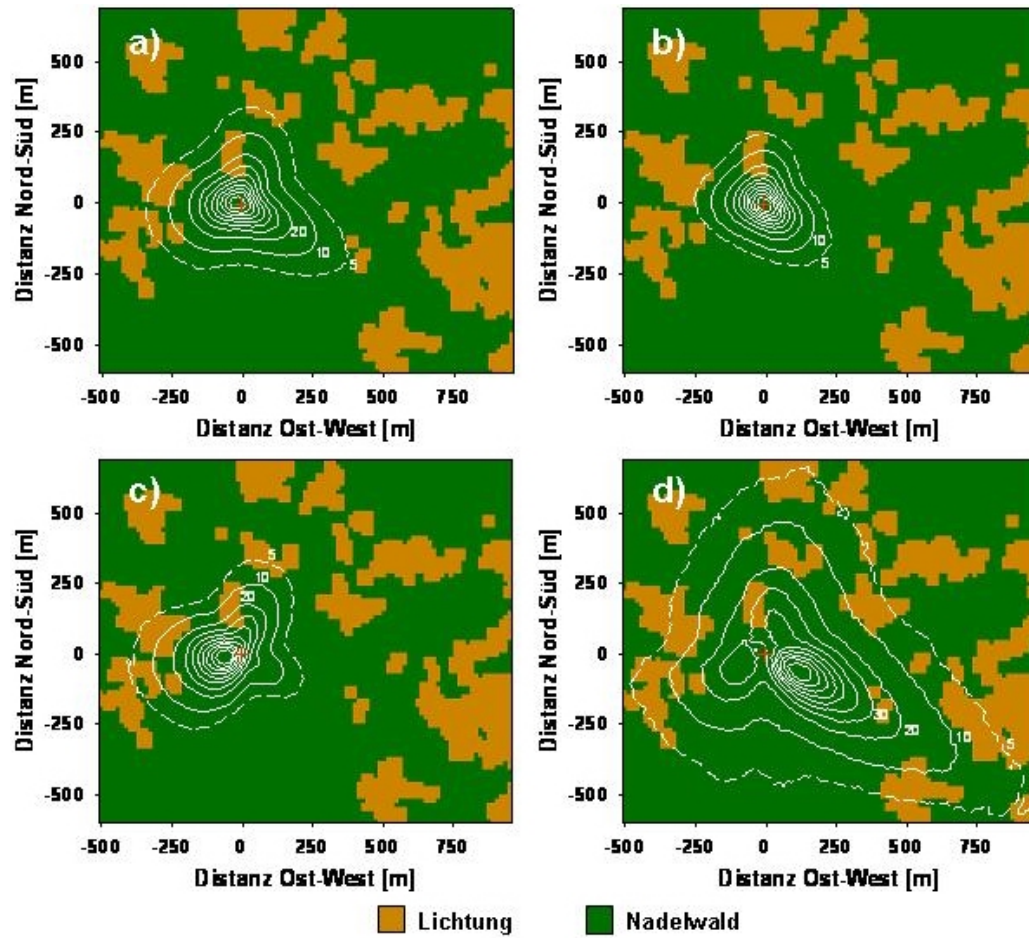


Figure 33: Footprint climatology over land use map, WALDATEM 2003, main tower according to Göckede et al. (2005). a) all stratifications, b) unstable, c) neutral, d) stable.

6.2 Land use fractions - main tower

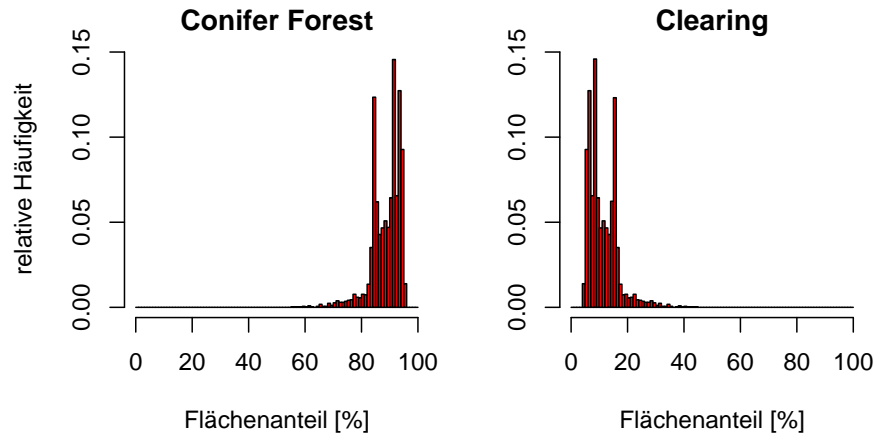


Figure 34: Relative contribution of different land use classes to the flux, **WAL-DATEM 2003, main tower** for all atmospheric stratifications. x-axis: land use percentage, y-axis: relative frequency.

7 Conclusions

The deliberately brief conclusions are: the main part of the footprint for both towers before and after the storm is dominated by coniferous forest. However, after the storm Kyrill on the 18th of January 2007, the footprint might completely cover large clearings during stable atmospheric stratification, which account for a substantial part of the footprint under those situations.

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A Appendix

The amount of wood cut before and after Kyrill is given in figure 35 and table 3.

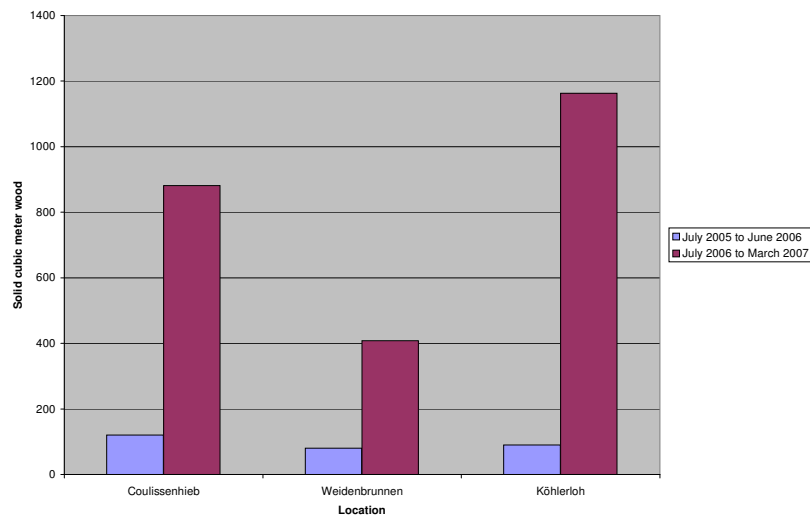


Figure 35: Volume of wood cut before (blue) and after (red) Kyrill (in solid cubic meters).

Table 3: Volume of wood cut before and after Kyrill. Data source: Bayerische Staatsforsten, Mr. Stöcker.

Location	Wood cut (solid cubic meter)	
	July 2005 to June 2006	July 2006 to March 2007
Coulissenhieb	119.95	881.04
Weidenbrunnen	80.36	408.07
Köhlerloh	89.61	1162.88

Table 4: Volumes in the series “University of Bayreuth, Department of Micrometeorology, Arbeitsergebnisse”

Nr	Author(s)	Title	Year
1	Foken	Der Bayreuther Turbulenzknecht	01/1999
2	Foken	Methode zur Bestimmung der trockenen Deposition von Bor	02/1999
3	Liu	Error analysis of the modified Bowen ratio method	02/1999
4	Foken et al.	Nachfrostgefährdung des ÖBG	03/1999
5	Hierteis	Dokumentation des Experimentes Dlouhá Louka	03/1999
6	Mangold	Dokumentation des Experimentes am Standort Weidenbrunnen, Juli/August 1998	07/1999
7	Heinz et al.	Strukturanalyse der atmosphärischen Turbulenz mittels Wavelet-Verfahren zur Bestimmung von Austauschprozessen über dem antarktischen Schelfeis	07/1999
8	Foken	Comparison of the sonic anemometer Young Model 81000 during VOITEX-99	10/1999
9	Foken et al.	Lufthygienisch-bioklimatische Kennzeichnung des oberen Egertales, Zwischenbericht 1999	11/1999
10	Sodemann	Stationsdatenbank zum BStMLU-Projekt Lufthygienisch-bioklimatische Kennzeichnung des oberen Egertales	03/2000
11	Neuner	Dokumentation zur Erstellung der meteorologischen Eingabedaten für das Modell BEKLIMA	10/2000
12	Foken et al.	Dokumentation des Experimentes VOITEX-99	10/2000
13	Bruckmeier et al.	Documentation of the experiment EBEX-2000, July 20 to August 24, 2000	01/2001
14	Foken et al.	Lufthygienisch-bioklimatische Kennzeichnung des oberen Egertales	02/2001
15	Göckede	Die Verwendung des Footprint-Modells nach Schmid (1997) zur stabilitätsabhängigen Bestimmung der Rauigkeitslänge	03/2001
16	Neuner	Berechnung der Evaporation im ÖBG (Universität Bayreuth) mit dem SVAT-Modell BEKLIMA	05/2001
17	Sodemann	Dokumentation der Software zur Bearbeitung der FINTUREX-Daten	08/2002
18	Göckede et al.	Dokumentation des Experiments STINHO-1	08/2002

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Nr	Author(s)	Title	Year
19	Göckede et al.	Dokumentation des Experiments STINHO-2	12/2002
20	Göckede et al.	Characterisation of a complex measuring site for flux measurements	12/2002
21	Liebenthal	Strahlungsmessgerätevergleich während des Experiments STINHO-1	01/2003
22	Mauder et al.	Dokumentation des Experiments EVA_GRIPS	03/2003
23	Mauder et al.	Dokumentation des Experimentes LITFASS-2003, Dokumentation des Experimentes GRASATEM-2003	12/2003
24	Thomas et al.	Documentation of the WALDATEM-2003 Experiment	05/2004
25	Göckede et al.	Qualitätsbegutachtung komplexer mikrometeorologischer Messstationen im Rahmen des VERTIKO-Projekts	11/2004
26	Mauder and Foken	Documentation and instruction manual of the eddy covariance software package TK2	12/2004
27	Herold et al.	The OP-2 open path infrared gas analyser for CO ₂ and H ₂ O	01/2005
28	Ruppert	ATEM software for atmospheric turbulent exchange measurements using eddy covariance and relaxed eddy accumulation systems and Bayreuth whole-air REA system setup	04/2005
29	Foken (Ed.)	Klimatologische und mikrometeorologische Forschungen im Rahmen des Bayreuther Institutes für Terrestrische Ökosystemforschung (BITÖK), 1989-2004	06/2005
30	Siebicke & Serafimovich	Ultraschallanemometer-Überprüfung im Windkanal der TU Dresden 2007	04/2007
31	Lüers & Bareiss	The Arctic Turbulence Experiment 2006 PART 1: Technical documentation of the ARCTEX 2006 campaign, May, 2nd to May, 20th 2006	07/2007
32	Lüers & Bareiss	The Arctic Turbulence Experiment 2006 PART 2: Visualization of near surface measurements during the ARCTEX 2006 campaign, May, 2nd to May, 20th 2006	07/2007
33	Bareiss & Lüers	The Arctic Turbulence Experiment 2006 PART 3: Aerological measurements during the ARCTEX 2006 campaign, May, 2nd to May, 20th 2006	07/2007
34	Metzger & Foken et al.	COPS experiment, Convective and orographically induced precipitation study, 01 June 2007 – 31 August 2007, Documentation	09/2007

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Nr	Author(s)	Title	Year
35	Staudt & Foken	Documentation of reference data for the experimental areas of the Bayreuth Centre for Ecology and Environmental Research (BayCEER) at the Waldstein site	11/2007
36	Serafimovich et al.	ExchanGE processes in mountainous Regions (EGER): Documentation of the Intensive Observation Period (IOP1) September, 6 th to October, 7 th 2007	01/2008
37	Serafimovich et al.	ExchanGE processes in mountainous Regions (EGER): Documentation of the Intensive Observation Period (IOP2) June, 1 st to July, 15 th 2008	09/2008
38	Siebicke	Footprint synthesis for the FLUXNET site Waldstein/Weidenbrunnen (DE-Bay) during the EGER experiment	12/2008